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ABSTRACT

Described is an information package with information on six science programs suitable for use in elementary schools. The programs selected for inclusion in the information unit were Elementary Science Study, Inquiry Development Program, Minnesota Mathematics and Science Teaching Project, Science Curriculum Improvement Study, Conceptually Oriented Program in Science, and Science--A Process Approach. Five major phases used to conceptualize, develop, and test the information package are described. In the first phase, the goals of the package were outlined. The second phase involved the development of the first complete form of the information package. In the third phase, a completely revised package was developed using the modifications recommended at the previous phase. In the fourth phase, the product was revised and used in a large number of sites across the country. The fifth phase was the development of the final product and its dissemination. This document contains several photographs of the information package as well as a discussion of the total program budget, and the costs for each phase. Bibliography. (LC)

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EDUCATIONAL DEVELOPMENT CASE STUDY: AN ELEMENTARY SCIENCE INFORMATION UNIT

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The Laboratory was established through a Joint Powers Agreement in February 1966. Signatories as of June 1969 include:

The Regents of the University of California
The California State Board of Education
The Trustees of the California State Colleges
The County Superintendent of Schools of the County of Monterey
The Board of Education of the San Francisco Unified School District
The Regents of the University of Nevada
The Nevada State Board of Education
The Board of Regents of the University of Utah
The Utah State Board of Education

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August 7, 1970

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FOREWORD

Educational development is emerging as a new discipline. As yet, its principal features are only generally understood, but its significance as a tool for educational reform cannot be seriously questioned. This case study of the development of a specific educational product by the Far West Laboratory for Educational Research and Development should prove helpful to those who wish to gain a better understanding of this new discipline.

The directors of regional educational research and development laboratories are being constantly bombarded with questions such as the following:

1. What are regional educational laboratories doing?
2. Exactly what is "educational development?"
3. What is the relationship between educational research and development?
4. Are special laboratories needed to perform educational development? Could it not be done better by a university--state departments of education--local teaching faculties?
5. What skills are needed by those who might consider a career in educational development?
6. When is the work of an educational development completed? How long does it take to develop a given product?
7. How much does it cost to develop a given educational product?

8. Are the results of money spent on educational development worthwhile?

This case study should begin to supply some information relevant to these questions. It is not assumed that one such study can answer them, but a reader who has not already found the answers to such questions will find the study helpful.

John K. Hemphill
Director
Far West Laboratory for
Educational Research and Development

AN EDUCATIONAL DEVELOPMENT CASE STUDY:

AN ELEMENTARY SCIENCE INFORMATION UNIT

SUMMARY

The number of new processes and products available to schools is increasing at a rapid rate. They are relatively complex and difficult to understand. On the surface they are no more appealing than the great quantity of material already available. We must ask ourselves:

> Do teachers and administrators have enough time to find, gather, and process information about the new developments?
>
> Do researchers and developers adequately disseminate information that is readable and understandable?

The Far West Laboratory believes that the answer to these questions is "no." As a result, the Laboratory has developed the Elementary Science Information Unit. The unit describes six new, relatively well developed programs suitable for science instruction in elementary schools. The information unit decreases the work load of the school personnel responsible for reviewing these developments for possible adoption. It assures that information about them is presented in a clear, effective format.

A separate report published by the Laboratory, "The Final Report of the Elementary Science Unit," describes the information unit and its use in detail. The current study is intended to be a record of the development effort behind the product.

This case study focuses on five major steps used to conceptualize, develop, and test the product:

In the first phase, Conceptualization and Planning, the goals of the unit were outlined. Briefly, the goal was to close the gap between the schools and the emerging field of educational research and development by

increasing the number of well developed options known to school decision-makers and by conveying knowledge about the alternatives to enable schools to accept or reject them rationally. The model developed was a multi-level, multi-media, mailable product describing alternatives in an objective manner. A non-directive instructional approach was adopted. A prototype of the unit was developed and submitted for "expert" evaluation. A pattern for field testing and evaluation was also devised, as well as a strategy for increasing the knowledge base behind diffusion efforts such as this one.

In the second phase, Preliminary Product Development and Testing, the first complete form of the information unit was developed. A strategy for selecting the science programs to be included was implemented, information was gathered and the specific elements of the product were written and produced. A field test involving 19 target audience subjects was conducted. The results indicated that there was a real need for the product and that the format was largely satisfactory, although a number of small modifications were recommended. Simultaneously, the subjects provided data on the relationship of "job function" to "search-set." Among other outcomes of this research was the conclusion that formal job classification (e.g., superintendent vs. teacher) has little to do with the type and nature of information required.

In the third stage, the Development and Field Testing of the Main Form, a completely revised unit was developed using the modifications recommended at the previous stage. One important change had to do with the media used. Field testing with a randomly selected sample of 19 schools was conducted. One hundred eighty-one target users were involved. Results indicated that the unit had satisfactorily passed all of the standards set for its objectives except in one area--knowledge retention. Recommendations were made to improve product performance in this area.

In the fourth stage, the Development and Field Testing of the Operational Form, the product was revised and used in a large number of sites across the country. This time the subjects were free to use the product in any way they wanted (as opposed to the controlled testing of the previous stage). Twenty-four schools were involved. Results were highly satisfactory and the product was recommended for release.

In the fifth stage, Development of the Final Product and Dissemination, considerable difficulties were encountered in securing a commercial distributor, resulting in the need for a relatively large amount of extra money to develop the final form. Dissemination of this form has now begun although no information on the number of sales is currently available except to note that 130 pre-publication sales were made at $75 each.

Elsewhere in this document, the background of the program which produced the product is described, legal constraints are outlined, and a "system development strategy" is reported.

Costs for the effort total approximately $222,000, excluding legal fees and the cost of the copies of the final form (to be recovered from sales). A breakdown of the budget data shows the cost of each stage as follows:

Conceptualization and Planning	$24,000
Preliminary Development and Testing	45,000
Main Form Development and Testing	46,200
Operational Form Development and Testing	47,800
Final Form	59,000
Total	$222,000

Of the total, approximately 50% ($110,000) was spent for personnel (salaries, wages, and benefits). Costs for materials and subcontracts related to the production of audiovisual materials (exclusive of personnel

costs) were approximately 14% ($31,000). The remainder (36%) went to all other costs--Laboratory management support, indirect costs (heat, light, communications, etc.), and other direct costs.

Another way of breaking down this total figure shows that a total of $117,000 (53%) went for actual development of the forms (information collecting, writing, typing, shooting photographics, revision, etc.), $38,000 (17%) went into field testing (travel, payment to participants, data analysis, etc.), $9,000 (4%) went into reporting (to Laboratory management, U.S.O.E., and the educational community in general), and the remainder of $58,000 (26%) went into management, recruiting, training, coordination, etc.

The case study also points to other payoffs this effort has had by: (1) allowing the program to develop similar products at less cost (a comparable information unit now under development is running at about 50% of the cost of the science unit) and (2) permitting an entire reconceptualization of the system so that it can meet more of its intended objectives as well as serve a larger scope of effort. The second payoff will result in a new product development phase, which is now under design; the planning document for this new design is unique--a complete design specification of an educational development.

INTRODUCTION TO THE PROBLEM

In 1965 Congress enacted the Elementary and Secondary Education Act, Public Law 89-10. Under Title VI of this act the Office of Education established a program of regional laboratories. The model for the laboratories left room for a variety of interpretations (see the "Hearings Before the Special Subcommittee on Education on the Study of USOE, 89th Congress"[1]) but it was clear that a new means was proposed to develop programs for the schools. Instead of relying on the "dissertation model" of research for new ideas and products, the laboratories were seen as "permanent institutions devoted to the discovery and dissemination of practical knowledge..."[2]

After the initial planning during 1965, the Far West Laboratory for Educational Research and Development was established in 1966 as a joint agreement between a number of California and Nevada educational agencies.[3]

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[1]U.S. Congress, House Committee on Education and Labor, Subcommittee on Education, Hearings, Study of the United States Office of Education (89th Congress, 1967, four parts). Also see Stephen K. Bailey, "Emergence of the Laboratory Program," Journal of Research and Development in Education, III (1970), 11-13.

[2]Bailey, op. cit., p. 6.

[3]Original signatories to the Joint Powers Agreement of 1966 were: The Regents of the University of California, the California Board of Education, the Trustees of the California State Colleges, the County Superintendent of Schools of the County of Monterey, the Board of Education of the San Francisco Unified School District, the Regents of the University of Nevada, and the Nevada State Board of Education. In 1969 the Board of Regents, University of Utah and the Utah State Board of Education were added to the signatories.

In its initial definition of focus the Laboratory staff identified six alternative areas for possible program development. Using a number of criteria, the six areas were narrowed to two major programs. The criteria used were: "importance, focus, breadth of tasks, payoff, feedback, compatibility with resources, organizational involvement, fundamental problem, potential duplication of effort, funding feasibility, breadth of application, political feasibility, balance of tasks, and overall risk." The "Communication Program" was one of those selected for initial development. The other program was "Teacher Education."[4]

The Purpose of the Communication Program was:

> To conduct those research, developmental and operational tasks that will bring into existence effective use of information about options available to school personnel as they make decisions in the organizational operations of schools.[5]

This goal was selected in an effort to close the gap between the schools and the emerging field of educational research and development. There was ample evidence that research had not found its way into established practice and it was important that the pattern not be repeated in the newly undertaken development effort.

Initial conceptualization of the components of the Communication Program took place between 1966 and 1967. The components identified were to focus on three efforts:

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[4]Far West Laboratory for Educational Research and Development, Program Plans (Berkeley: Far West Laboratory for Educational Research and Development, March, 1967), pp. 7-8.

[5]Ibid, p. 42.

Component 1: The development and refinement of media products to create awareness, realistic expectations, positive attitudes and motivation, and a supportive climate relating to research and development and rational educational planning;[6]

Component 2: The development and establishment of an effective information system, specifically designed for school personnel and limited to educational research and development information;

Component 3: The identification, development, and dissemination of organizational arrangements and personnel training programs that will permit school personnel to use research and development information effectively.[7]

This document is a case study of the first product of Component 2--the information system. The product is the Elementary Science Information Unit. The case study is intended to provide sufficient detail to enable the reader to understand the complexity and costs involved in the empirically based development of an education product.

The strategy used to identify, create, test, revise, retest, and market the product is patterned after industrial and military models. The Laboratory staff identified five major stages through which the product had to pass. The stages were further subdivided into more detailed phases. The bulk of this document describes these phases in terms of the development of the Elementary Science Information Unit.

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[6]The goals of the component were eventually changed.

[7]Far West Laboratory for Educational Research and Development. Basic Program Plans (Berkeley: Far West Laboratory for Educational Research and Development, 1968).

STAGES OF DEVELOPMENT

Stage 1: Conceptualization and Planning

Purpose of This Stage. As defined by the overall developmental strategy of the Laboratory, this stage included:

> need definition, a thorough review of the research literature and practices that seem to be relevant to the particular needs and problems on which the program or component is focused, a detailed statement of objectives to be achieved through the use of the product and preparation of initial specifications of the product.[8]

Steps of This Stage. For the purposes of this paper the work of stage 1 will be divided into eight subsections: identifying the research base, describing the requirements, goals and target audience, developing the prototype and model, selection of content, production and scheduling, personnel, time and costs.

Identifying the research base. Literature searches and professional judgement led the staff to conclude that an extensive research base did not exist for the development of a product in the proposed area. While research had been conducted on the general variables that influence the adoption-decision process,[9] little of it suggested a specific developmental strategy. The most relevant work was from rural sociology. Rogers, for example, was instrumental in pointing to the importance of a successful

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[8]Far West Laboratory for Educational Research and Development, Contractor's Request. (Berkeley: Far West Laboratory for Educational Research and Development, 1970).

[9]For a good current summary see R. G. Havelock, Planning for Innovation (Ann Arbor: University of Michigan, Institute for Social Research, 1969).

product being divisible, simple (as opposed to complex), easy to understand (communicable), compatible with existing procedures, and clearly advantageous over alternatives.[10]

From Guba[11] the staff adopted a specific product development strategy of telling and showing rather than "helping, involving, training, and intervening." "Telling and showing" seemed most likely to produce a cost-effective approach to the goals of the component. In other words, it was believed that in order to reach the largest target audience most effectively, any idea or practice had to be formed into a tangible, operational product that could be distributed easily and inexpensively. While other strategies involving direct services to schools might be more powerful in the isolated case, it was judged that it would be most cost-effective to create a mailable product describing new innovations in a decision-making framework. The staff recognized, of course, that if this approach were not well conceived and tested, effectiveness would be low since the approach was not closely coupled with the schools' current practices.

Describing the requirements, goals, and target audience. In a series of staff papers the goals and the target audience were identified. Briefly, the goals were identified as:

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[10] E. M. Rogers, Diffusion of Innovations. (New York: The Free Press or Glencoe, Inc., 1962).

[11] E. G. Guba, "Development, Diffusion and Evaluation," Knowledge Production and Utilization, eds. T. L. Eidell and Joanne M. Kitchel, University Council on Educational Administration and the Center for Advanced Study of Educational Administration (Eugene: University of Oregon, 1968).

(1) Increasing the number of well researched and developed program options known to school decision makers;

(2) Conveying specific knowledge of these programs sufficient for:

(3) Educational decision-makers to select from among the alternatives the one best suited to their goals or reject them all if none were satisfactory.

In addition, secondary goals were developed:

(4) The target audience must like the product developed;

(5) believe it serves their needs, and

(6) prefer it to all other equal or less costly means of achieving the same objectives.

The target audience for the proposed product were those members of a local educational unit (school building or district) responsible for curriculum decision-making. It was assumed that almost all of a district's personnel might be involved at some point--assistant teachers, teachers, department heads, vice-principals, principals, supervisors, coordinators, consultants, deputy/associate/assistant superintendents, superintendents, community advisory groups, and school boards. However, it was assumed that the principals, supervisors, coordinators, consultants and teachers (when the latter served in an administrative capacity) were the key members of the target audience.

In a detailed analysis of these potential members of the target audience[12] it was assumed that not all of these decision-makers had the same information needs. Differences existed both in terms of the type and detail of information required by the target audience. Thus it was clear that whatever product eventually emerged had to be flexible both in

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[12]Paul D. Hood, "The Integrated Information Unit and Its Possible Utilization by School Personnel" (unpublished paper, Far West Laboratory for Educational Research and Development, 1967).

terms of type of information (content, objectives, training requirements, price, etc.) and detail (from short summaries to detailed technical reports). This decision seemed compatible with the research work of Rogers mentioned previously.

Developing the prototype and model. During the first phase of the developmental cycle the Laboratory commissioned the Lockheed Missiles and Space Company to conduct a detailed survey of the information needs of the target area of the Laboratory. The report was completed in November of 1966. Though the report had many purposes and other conclusions, the findings relevant to the present case study included these abstracted items:

(1) There was general lament from all levels of education about the lack of communication in the field and about the number of independent efforts that were proceeding without awareness of each other.

(2) There was a lack of significant research information to disseminate.

(3) Research findings needed to be translated into a form which is understandable by the school constituency.

(4) There were a large number of media channels that could be utilized; most were in the sphere of either the mass media or the highly technical area of computer science.[13]

The results of the survey included the definition of a number of specific vehicles that might be used to effect the needed communications link. These included: the development of a "data book" that would be available to all school personnel, a laboratory publication service, a program "alert" service

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[13]Lockheed Missiles & Space Company, Communication and Utilization Study (Sunnyvale, Calif.: Lockheed Missiles & Space Company, 1966).

utilizing existing mass media channels, development of a systems planning guide (a handbook), and the operation of a field demonstration unit. The development of a large scale computer-based information system was also suggested.

Eventually all of these ideas were rejected though the study served to confirm the need for an information system that would enable school personnel to know of educational developments and select among them. The reasons that the alternatives were rejected included these: While highly visible, it was believed the "data book" would not be well focused and might degenerate into "the stuff" that tends to pile up on desks and in files; it was believed that the product would have to be more unique. The publication service was rejected because other agencies already provided that service. The program "alert" was tentatively selected as a means for implementing Component 1's objectives (see above); however, when a series of educational television programs developed as an "alert" reached only 5% of the potential target audience it was dropped. The system planning guide was rejected as not being enough on target for the purposes of the product. the field demonstration unit violated the "telling-showing" product development constraint and was thought to be too costly for the small target audience that would be reached. The use of a computer-based information system was rejected on the grounds that not enough schools now had such facilities (and were unlikely to get them in the near future) and the interconnection costs were too expensive at present.

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[14] Ibid.

The eventual model that was conceived for the product was one invented by the staff of the Laboratory. It consisted of a multi-level package of multi-media materials suitable for use by school personnel as they considered alternative ways to achieve their educational goals and objectives. An assumption was made that providing information about several feasible alternatives in the same product would assist the rationality of the decision process. It was also assumed that if all or most of the critical information (pro and con) was made available in a useful format there would be a better chance that the right choice would be made for the particular situation.

In the March 19 Laboratory Activities a schematic of the proposed product was introduced. (See figure 1.)

The name assigned to the product was the Integrated Information Unit. The term "integrated," originally included to suggest the multi-media, multi-level format, was eventually dropped for simplicity.

As shown in the schematic, the model had four levels of information--an initial overview to all the programs, a more detailed audiovisual summary of each program, a booklet describing each program in more detail, and finally, a set of background references. Film was used at levels one and two, print at levels three and four. Each program was treated in a parallel way to permit adequate comparison between the alternative programs. It was decided that each information unit would be focused on a single set of alternatives in a given area.

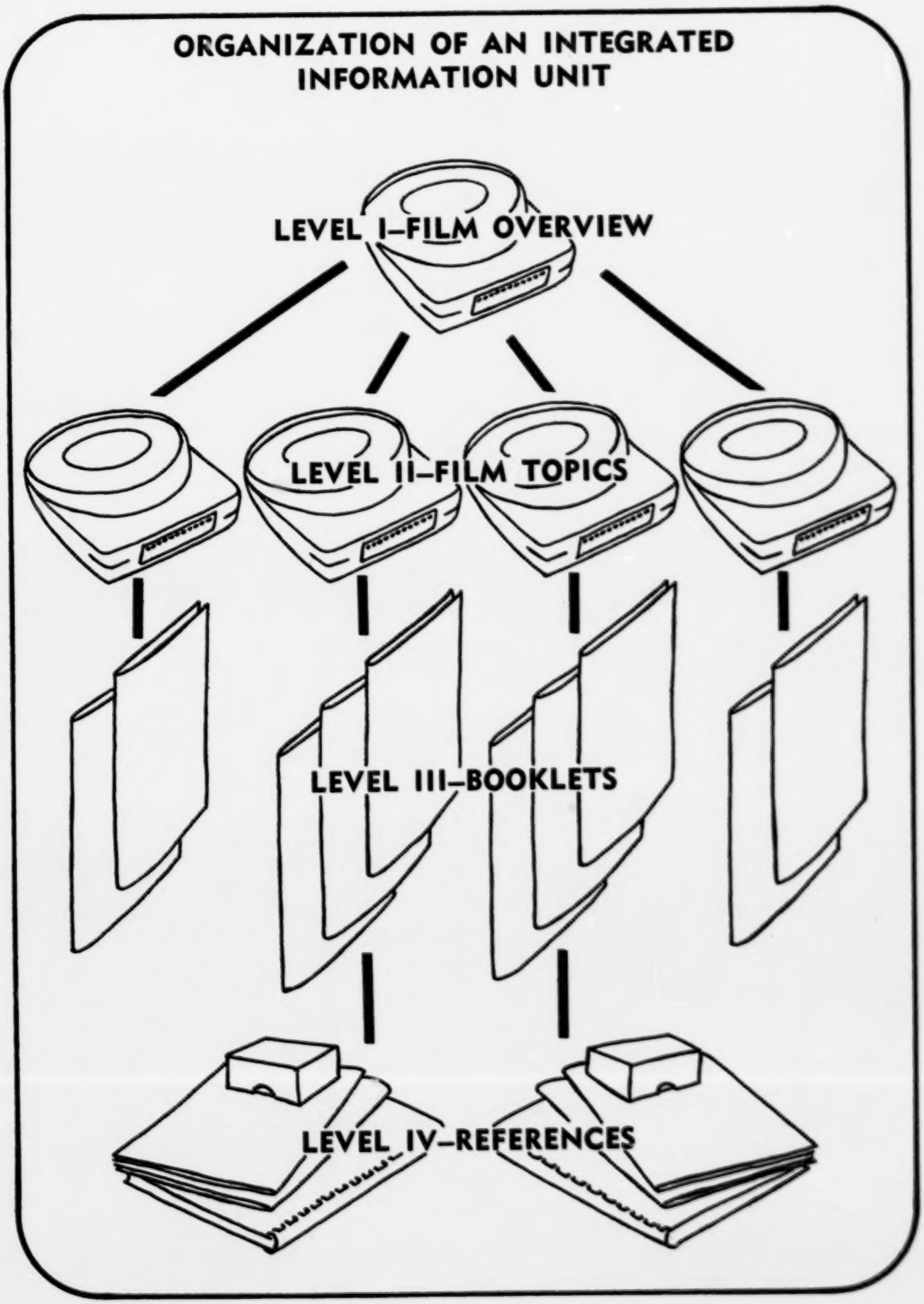

Figure 1
The Proposed Model for the Information Unit

The instructional pattern behind this model included a series of assumptions:

1. The curriculum-adoption, decision-making practices of schools are extraordinarily varied; no single model of how needs are assessed, goals and objectives identified, information about alternatives gathered and processed,--and decisions made can be established among school organizations. It is assumed that the processes in most cases involve multiple, recurring encounters with needs, goals, and information--rather than a one-dimensional model of the processes.

2. It is assumed that a great variety of personnel is involved--ranging from parents and students to teachers and administrators. It is also believed that the variation in information processing behaviors is as broad within groups as it is among groups. In general, the process is assumed to involve both group and individual acts ranging over a period of time.

3. It is assumed that the types of information needed will vary greatly from one individual to another and from one group to another.

4. It is assumed that motivation to want and need the type of information provided by the unit must exist before coming to the unit; the unit cannot induce review and rational consideration of new alternatives leading to adoption unless the user is inclined in this direction.

5. It is also assumed that a mailable package of information about new curriculum projects is a necessary but not sufficient stimulus for rational decision-making; other types of materials and contacts must also be present to lead to the terminal behaviors of adoption, adaptation or rejection.[15]

Most of these assumptions were untested and research about them was lacking. As a result, the choice of strategies was either to make a considerable initial effort to find evidence supporting or rejecting these assumptions or to begin development and attempt to establish supporting research as we went along. The latter course of action was the one adopted. In this specific case, the result in design included these instructional characteristics:

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[15]C. L. Hutchins, A Final Report on the Elementary Science Information Unit (Berkeley: Far West Laboratory for Educational Research and Development, 1970).

1. Except for the initial instructions, the sequence for using the unit was not linear or discursive; entry to the body of the content was by multiple paths suiting the variety of styles used by individuals and organizations. Hence, the need for each major part to be relatively independent of the others. Redundancy exists where the prerequisite information is necessary to understand particular cognitive elements.

2. The information must be available in multiple forms suitable for use by individuals and groups.

3. The information must cover a range wide enough to fit multiple needs; if an error is committed it should be on the side of comprehensiveness rather than exclusiveness.

4. Though motivation is presumed, the unit should provide sufficient "persuasion" that the user already inclined toward the use of such an approach will be induced to believe that the product is well-adapted to his needs.

5. The package must be flexible enough to be used as an auxiliary to other materials and in a variety of situations involving its use by "linking agents," peers, and such formal channels as pre-service education.[16]

Alternative means could have been selected. The staff described these alternatives:

The information could have been brochures, pamphlets, position papers, etc. from the developers of the new science programs themselves. This approach was rejected because information about different programs would not be comparable, i.e., objective. Not all of the developments had suitable materials available.

The information could have been the curricula themselves. This approach was rejected because of the high cost of most of the programs (complete sets of materials could easily have run to several thousand dollars).

The approach could have been more of a demonstration project requiring the users to come to some national, regional or local information center. This was rejected because of the additional costs and inconveniences required for use and the fewer number of users that would have, in all likelihood, used the product.

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[16] Ibid.

The direct, demonstration approach was also rejected because to some extent curriculum information centers already exist in large school, county, regional, state or national libraries and demonstration centers.

The use of the package could have been more directed or guided; the pattern of use could have been "programmed." This alternative was rejected because of the absence of information on how users currently make curriculum reviews; it was assumed that different groups follow strikingly different patterns of review. In other words, the product was designed to fit present practices rather than developing a new pattern that would require major changes in most users' behavior.

A more active (rather than passive) approach probably could have been designed. Any failure here was more a lack of inventiveness than systematic rejection of alternatives.

The product could have used a single level of information approach and a single medium. The multi-level, multi-media approach was selected to insure versatility and flexibility in adapting to the user's present practices.[17]

The model that evolved from the research and testing cycle has a remarkable overall similarity to the one proposed during the conceptual planning. However, there have been a number of changes. It is the intent of this paper to document these changes and to suggest that the initially conceived product, if executed and disseminated immediately, would have failed. Only the many changes that have occurred--small, though some of them may be--make the final product a successful one--not just because of its effects on users, but also because of its total reflection of a system of production, testing, marketing, etc.

Selection of the content. During the Planning and Conceptualization stage, work was conducted to identify the subject area in which the first information unit would be developed and to select the specific programs that would be covered. During the summer and fall of 1967 a contract was

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[17] Ibid.

let with Davidson Films to conduct a survey of potential subject areas and to help to identify programs for ultimate inclusion in the information unit. Davidson Films was selected because of the experience Mr. Davidson and his staff had with a number of the evolving "new curricula" and because of his knowledge of their suitability to the information unit approach which had been selected. The contract also focused on identifying the media that should be used in developing the information unit. The survey included personal interviews and visits with leading media agencies (DAVI, Eastman Kodak, etc.) leading educational developers (EDC, NSF, the High School Geography Project, etc.) and with agencies and groups interested in information and dissemination (EPIE, ERIC, IDEA, etc.) The conclusions of the survey strongly supported the multi-media approach that had been selected.[18] In consultation with the Laboratory, Davidson also recommended that the initial package should be developed in the field of elementary science. It was clear from the outset that because of extensive NSF funding, the science and math areas were likely to be the best areas for investigation. Science was selected over math primarily because, at least in the Far West Laboratory's region, science curriculum selection was in much greater ferment than math. Elementary science was selected over secondary science because it was felt that the secondary programs were older and better known, but that a substantial investment in elementary science curriculum development had been made--in excess of $10,000,000 at that time--with few of the products yet being used.

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[18]J. M. Davidson, "Projects Developing Communications Systems for Educators" (San Francisco: Davidson Films, 1967).

Three criteria were applied to select programs for the information unit. First, the program or curriculum package had to follow the trend in elementary science instruction toward active involvement of students in scientific processes and experience rather than in passive reading or listening to accounts of scientific facts, theories, or history. Specifically, the program had to provide opportunities for the students to manipulate objects and observe functional relationships typical of the kind in which scientists engage. To qualify, a program had to either include special materials for the students to work with or call for work with materials readily available to the typical classroom teacher. But in either case, such activities could not be appended to a reading chapter as "suggestions for further study"; they had to be an integral part of the program. The second criterion was the requirement that the program had undergone a research and development cycle comparable to the one developed by Far West Laboratory. Specifically, there had to be a systematic attempt to field test and operationally confirm that the product worked before its release. Furthermore, there had to be some evidence, behavioral or otherwise, that the program was meeting its objectives. In point of fact, this was a very difficult criterion to apply since very few curriculum developments specify the behavioral objectives required for rigorous evaluation. The third criterion was that the materials were, or soon would be available for widespread adoption across the country; it seemed futile to describe programs that were unavailable.

Scheduling. The final step of the Planning and Conceptualization phase was to develop a series of planning documents that could be used to

direct production of the information unit.[19] These documents were focused particularly in the area of production and evaluation. PERT schematics were drawn up to project a tentative schedule for the development. For example, a schematic of the stages involved in the design of a single film in the unit was included in one of the planning documents. (See figure 2). Each step will be fully detailed in the text.

Personnel. During the Planning and Conceptualization phase the project personnel consisted largely of senior staff members. No project director had been selected. Planning and conceptualization was the responsibility of the program director, a Ph.D. in psychology with a background in instructional systems development in a military-based development agency. Much of the "inventing" and conceptualization was conducted with the aid of the Laboratory Director and the directors of other programs. Midway through the planning phase two permanent project people were hired--one at the MA level and one at the BA level. One clerical assistant was used about 3/4 time. The backgrounds of these people were not in communications or information dissemination. One had background in educational philosophy and the other in social studies and the operation of government projects.

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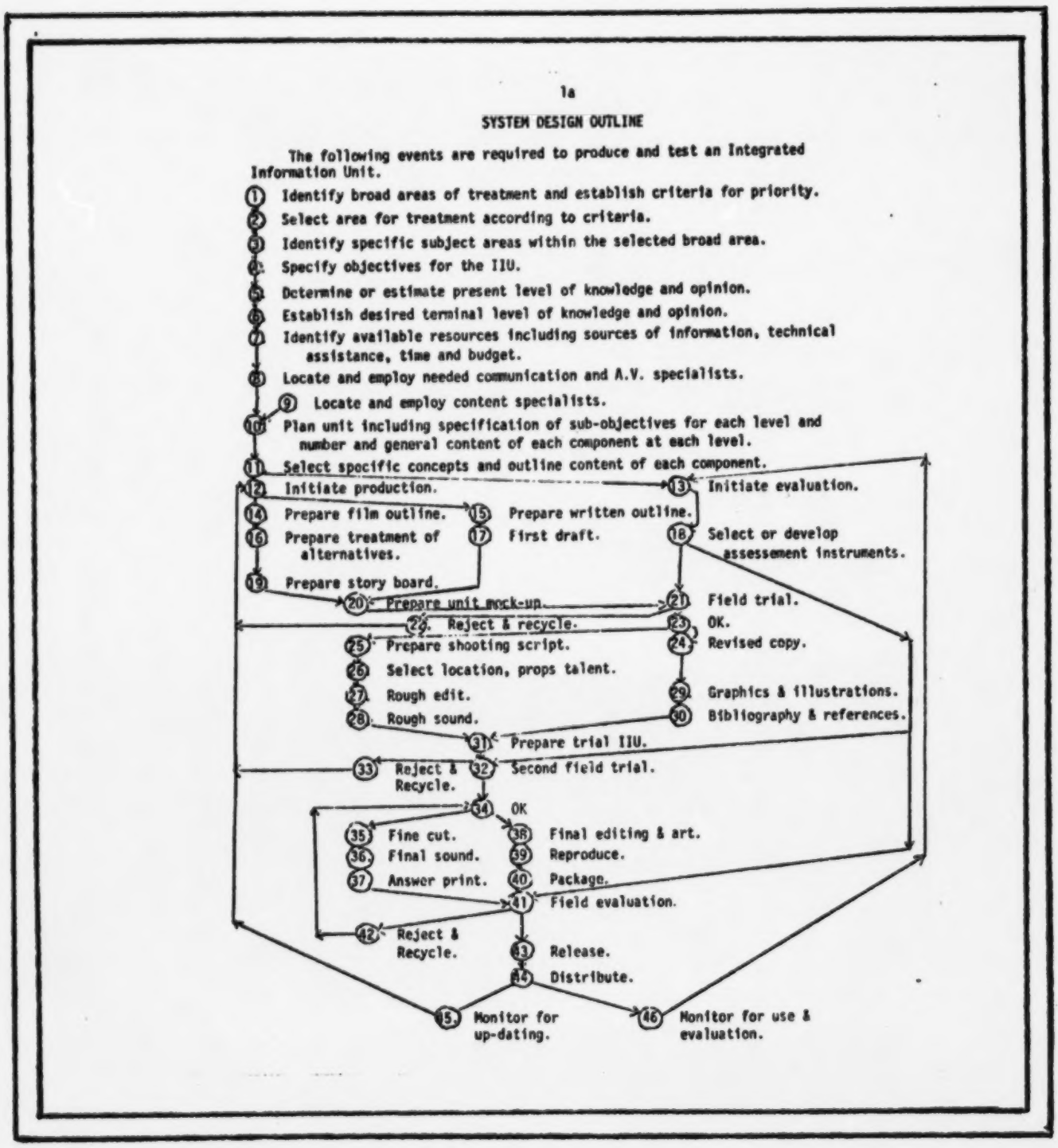
[19]Paul D. Hood, "The Production of an Integrated Information Unit" (Berkeley: Far West Laboratory for Educational Research and Development, 1966), and "The Evaluation of an Integrated Information Unit" (Berkeley: Far West Laboratory for Educational Research and Development, 1966).

Figure 2

System Design Outline for Production of a Single Audiovisual Component of an Integrated Information Unit[20]


1a
SYSTEM DESIGN OUTLINE
The following events are required to produce and test an Integrated Information Unit.
1 Identify broad areas of treatment and establish criteria for priority.
2 Select area for treatment according to criteria.
3 Identify specific subject areas within the selected broad area.
4 Specify objectives for the IIU.
5 Determine or estimate present level of knowledge and opinion.
6 Establish desired terminal level of knowledge and opinion.
7 Identify available resources including sources of information, technical assistance, time and budget.
8 Locate and employ needed communication and A.V. specialists.
9 Locate and employ content specialists.
10 Plan unit including specification of sub-objectives for each level and number and general content of each component at each level.
11 Select specific concepts and outline content of each component.
12 Initiate production.
13 Initiate evaluation.
14 Prepare film outline.
15 Prepare written outline.
16 Prepare treatment of alternatives.
17 First draft.
18 Select or develop assessement instruments.
19 Prepare story board.
20 Prepare unit mock-up.
21 Field trial.
22 Reject & recycle.
23 OK.
24 Revised copy.
25 Prepare shooting script.
26 Select location, props talent.
27 Rough edit.
28 Rough sound.
29 Graphics & illustrations.
30 Bibliography & references.
31 Prepare trial IIU.
32 Second field trial.
33 Reject & Recycle.
34 OK
35 Fine cut.
36 Final sound.
37 Answer print.
38 Final editing & art.
39 Reproduce.
40 Package.
41 Field evaluation.
42 Reject & Recycle.
43 Release.
44 Distribute.
45 Monitor for up-dating.
46 Monitor for use & evaluation.

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[20]Paul D. Hood, "The Production of an Integrated Information Unit."

Time and Costs. The conceptualization and planning of the Elementary Science Information Unit took place between 1967 and 1968. The cost for this stage was approximately $24,000, including a $3,500 subcontract to Davidson Films for a field survey.[21] The cost of the Lockheed study is not included in these figures since that work was used to support the design of the entire Communication Program; the information unit was not specifically considered, even though the need assessment features of the study were eventually used to support the conceptualization of the unit.

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[21]The percentage of the total costs devoted to personnel and media at other stages will be reported separately; a more detailed breakdown will also be given. It was not possible to extract the figures for this period.

STAGES OF DEVELOPMENT

Stage 2: Preliminary Product Development and Testing

Purposes of this stage. As currently outlined by the Laboratory, this stage is separated into two phases:

> Phase 1, preliminary product development, represents all the work necessary to create the first form of the product. All the ingenuity and creativity of the staff is brought to bear on the development of what appears to be the most useful product. Frequently non-Laboratory participants and school personnel are consulted in the development of the preliminary product; certainly such development is more than just putting together a number of pieces or ideas that others outside the Laboratory have tried out. This phase terminates with the decision that the preliminary product is sufficiently well defined and developed to merit testing. For some products, this preliminary product development may be quite complex, and may include a major portion of the development effort; in other instances the preliminary product may be only a very rough approximation of a final product.
>
> In the second phase, preliminary field testing, the product is tested in a preliminary field test for its feasibility as an idea. The evaluation is most often conducted using relatively small numbers of representatives of the intended target audience who are acquainted with the problems to which the product is directed. The participants in this preliminary field test, or feasibility test, are generally given the opportunity to respond freely to questions posed by the staff, as well as to draw attention to problems or questions not previously identified by the staff.[22]

These phases are explained under the headings: Selection of the Science Program, Gathering the Information, Copyright Constraints, Developing the Preliminary Form, the Preliminary Field Test, Conclusions, Personnel, and Time and Costs.

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[22]Far West Laboratory for Educational Research and Development, Contractor's Request.

Selection of the Science Programs. The general criteria for selecting the elementary science programs to be included in the unit were outlined in the description of the planning and conceptualization stage. During preliminary development a number of sources were used to identify a set of programs. These included the Davidson study previously described and the International Clearinghouse on Science and Mathematics Curricular Developments.[23]

The programs selected for inclusion in the preliminary form of the information unit were:

Elementary Science Study (ESS)
Developer: Education Development Center
Current publisher: McGraw-Hill Book Company, Webster Division.

Inquiry Development Program (IDP)
Developer: J. Richard Suchman
Current publisher: Science Research Associates

Minnesota Mathematics and Science Teaching Project (MINNEMAST)
Developer: Minnesota Mathematics and Science Teaching Project
Current publisher: MINNEMAST, University of Minnesota

Science Curriculum Improvement Study (SCIS)
Developer: Science Curriculum Improvement Study
Current publisher: Rand McNally and Company

Science--A Process Approach (S--APA)
Developer: The Commission on Science Education of the American Association for the Advancement of Science
Current publisher: Xerox Educational Division

The science areas covered by these programs were general science, physical science, and biological science. Very little astronomy or earth science was covered. Mathematics was given equal emphasis in one program (MINNEMAST) and was featured prominently in several other programs.

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[23]J. D. Lockard, Fifth Report of the International Clearinghouse on Science and Mathematics Curricular Developments, 1967 (College Park: University of Maryland, 1967).

The programs were intended for all elementary school pupils (K-6). There was no indication from the developers that any special segment of the student audience (projected high school science majors, slow-learners, etc.) had been especially targeted. The grade coverage of each program was as follows:

ESS:	K-8
IDP:	4-8
MINNEMAST:	K-3
SCIS:	1-6
S--APA:	K-6

The concepts and processes covered by the programs marked a significant departure from the traditional content of elementary science programs. The developers of all of these new programs believed that meaningful science learning would not occur if the focus was on having students memorize the products or output of science--the facts, laws, hypotheses--that are produced by scientists. Instead, they argued that children should learn science itself--the skills of observing, measuring, inferring, predicting and testing employed, as well as the major concepts used by scientists to explain and organize facts and theories. These concepts were more than new facts to be memorized; they were mental "pegs" by which the students understand nature. Concepts or conceptual schemes included were: organisms, ecosystems, systems, variables, conservation of energy, the statistical view of nature and the particulate nature of matter.

Gathering the Information. Following the selection of the programs, the collecting of detailed information about each of them began. As it turned out, this step proved to be complicated. All of the major curriculum development projects (in all subject fields) are not well set up to handle dissemination. After a short time they usually are so bombarded with requests

for information that a public relations officer is required. Except for writing a few brochures and newsletters, handling site visitors, and attending conventions, these men are usually more concerned with keeping detailed information about the projects from getting out than vice versa. There seems to be almost a veil of secrecy which drops over the projects. The reasons for this secrecy are complex--probably including the difficulty in keeping up with changes in a rapidly moving development project, the large amount of time required to answer detailed questions, and, perhaps, the desire to curtail information about certain "trade secrets" used by the development that others might lift and thereby weaken the project's uniqueness. In the particular case at hand, the developers were also concerned about the ability of the Laboratory, at the time a relatively unknown organization, to describe their project adequately.

In any event, this step was more difficult and time consuming than originally anticipated. Information from the projects frequently was hard to get, sometimes inconsistent, usually incomplete, and in many cases difficult to understand. The original judgment that school people would have difficulty in learning about the projects in sufficient detail to adopt or reject them seemed to be confirmed.

Legal Constraints

Copyright constraints. One area in which there were potential legal constraints concerned the copyright laws as they related to the use of materials already copyrighted. At this stage the program staff had to determine its obligations to respect the copyrights of the developers' materials. Considerable thought was given to this problem and it was resolved in the following manner:

Although the new revision of the copyright laws was still in Congress, it was believed the issues that were holding up the bill were not related to the matter at hand and so it was hoped that most relevant sections of this bill would remain intact. Specifically Section 107 of the proposed law seemed relevant:

> Notwithstanding the provisions of Section 106, the fair use of a copyrighted work, including such use by reproduction and copies or phono records or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching, scholarship, or research, is not an infringement of copyright. In determining whether the use made of the work in any particular case is a fair use factors to be considered shall include-- (1) the purpose and character of the use, (2) the nature of the copyrighted work, (3) the amount and substantiality of the portion used in relationship to the copyrighted work as a whole, and (4) the effect of the use upon the potential market for or value of the copyrighted work.24

Given these limitations on exclusive rights, it seemed that selection of portions of curricular and promotional materials from the programs being reviewed and reproducing them in the information unit came within the scope of criticism, comment, reporting, teaching, schlorship and research and was therefore not an infringement of copyright. The "determining factors" seemed to be as follows:

(1) The Purpose and character of our use was clearly non-profit--a purpose traditionally recognized by the copyright office and specifically acknowledged in the judiciary committee's report on the copyright law. (It should be noted, though, that in their discussion of "purpose and character," they also mentioned the spontaniety of the act, the fact of a

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[24]U. S. Congress, House Committee on the Judiciary, A Bill for the General Revision of the Copyright Law, Title 17 of the United States Code, and for Other Purposes (H. R. 4347, 89th Congress, 2nd Session, October 12, 1966). pp. 80-81.

single copy rather than multiple copy, the fact of copying from a collection rather than from a single issue as being legitimate exemptions--none of which were applicable to our situation.)

(2) Nature of the copyrighted work--Because we were not copying material that was consumable (workbooks, exercises, etc.) we probably qualified for exemption under this factor. (Interpretation of this section was not easy because it overlaps with the following one.)

(3) Amount used--A principle basis for our fair use claim was the fact that we had not copied the entire work or anything resembling the entire work. We merely extracted certain sections and elements that seemed appropriate to our work of criticism and reporting (the old cliche about a paragraph being the maximum amount that one can copy is not an explicit criterion of the proposed law).

(4) Effect of use--Finally, in copying we had clearly not affected the potential market or value of the work by removing such substantial portions that our copies could replace the original work. The products of IDP, SCIS, etc. are teaching-learning products and one could hardly argue that the information unit replaces the original in such a way as to enable someone to teach from it. In fact, under most circumstances our copying should increase, not decrease, the copyright holder's sales.

As a result of this analysis, therefore, it was concluded that we did not have to be concerned with legal constraints on our procedure of abstraction of small samples of copyrighted works for our comment and criticism of them for educational purposes.

Developing the preliminary form. Work on the preliminary form began late in 1967 and continued through 1968. The form developed consisted of the following:

Level I. A slide/tape presentation of the overview. (A script for the overview film was turned over to a commercial film production company for completion, but it was not delivered in time to be used during the preliminary field testing.)

Level II. Various audiovisual forms were used to develop briefings on each of the programs included. The S--APA briefing was a black and white film produced by an outside film production company. The SCIS and IDP briefings were color slide/tape presentations with cartoon figures. The ESS briefing was available only in the form of a script. No "level two" presentation was available for the Minnesota Mathematics and Science Teaching Project.

Level III. Printed drafts of reports on all programs were developed. The organization of these drafts was as follows:

History
Rationale
Objectives and Goals
Curriculum Organization
Educational Processes
Requirements for Implementation
Effectiveness and Evaluation
Appendix

Level IV. Background information was omitted in the preliminary form.

The purpose in the variety of media formats to the preliminary field test was to provide an opportunity to examine which media would be most acceptable to users.

Where possible all of the materials were reviewed by the project's personnel for accuracy.

Pictures of the mockup and preliminary forms are shown in figures 3 and 4.

Figure 3
The Mockup of the Elementary Science Information Unit

Figure 4

The mockup was developed to give the preliminary test subjects a view of the overall design of the product as it was projected for final form. It was believed that this form was needed in view of the diverse media used in the preliminary form and the difficulty the subjects likely would have in envisioning the completed product.

The preliminary field test. The preliminary field test took place on May 16, 1968, with 19 field test subjects from the Bay Area. They were selected to represent a cross-section of teachers, central staff curriculum coordinators and administrators as well as a cross-section of public and private schools. The test was administered in the Laboratory.

The general questions that the preliminary field test was designed to answer were these:

Is the project feasible?

Are the needs for the product real?

Is the proposed model likely to be successful?

To get answers to these questions the following tests and prodedures were used according to the time schedule indicated.

1 week before arriving	Subjects completed a form by mail identifying their educational background, present responsibilities, current role in curriculum decision-making, attitude toward curriculum reform, and current knowledge of the science programs to be included in the information unit.
9:00 a.m.	Subjects were given an oral explanation of the work of the Laboratory.
	A two-page pretest was administered; the questions focused on the attitudes toward reform of the elementary science curricula, current evaluation of the difficulty in getting information about science programs, and the subjects' current knowledge of the new programs to be described in the information unit.

9:30 a.m.	Subjects were shown the audiovisual overview. Immediately following, they completed a four-page questionnaire designed to assess their attitude toward the presentation, changes in their knowledge and their retention of certain points of the presentation.
10:15 a.m.	Break.
10:30 a.m.	(With a one-hour lunch break.) Subjects were randomly divided into two groups--half saw the audiovisual and read the reports on two programs (S--APA and MINNEMAST) and the other half saw the audiovisual (script in the case of ESS) and reports on the other two programs (ESS and SCIS). Immediately following each presentation and after reading each report, subjects responded to brief (three page) questionnaires directed to general reactions, attitudes, and knowledge.
2:30 p.m.	The entire group reconvened to take a posttest questionnaire and to engage in a group discussion.

Conclusions. As indicated by the schedule, a great deal of data was collected during the field test. A detailed presentation of the results will not be made here. But the following conclusions were reached as a result of the analysis:

First, it appeared there was a real need for the product. Pretest knowledge about the programs was very low--only a few of the subjects even knew of the existence of most of the programs--none knew of all of them. They all agreed that information about the programs was difficult to get and was needed.

Second, the proposed format seemed successful. A number of changes were recommended (for example, the inclusion of certain information that had been omitted and re-emphasis on other types of information), but overall the product seemed to be highly valued and liked by the target group.

Third, because only a slight difference could be detected between reactions to the film and to the slide/tape formats and the staff's knowledge of the differential in cost and time in producing films, a decision was made that during the main form development an effort would be made to develop the audiovisual component of the information unit in a slide/tape format.

These conclusions, of course, were relatively subjective, given only 19 subjects. But the staff felt confident that a satisfactory exposure of the proposed product had been made to a representative target group and that main form development should begin.

In addition to the testing described above, the preliminary field test subjects were used for some more detailed research into the question of the type and nature of information that various school personnel need for curriculum decision-making. This research is a good example of the way in which applied research can be balanced with development in a product-oriented program. As noted elsewhere, a sufficient research base did not exist at the time this development was started. Rather than build one as a foundation before beginning development, however, the strategy selected was to couple research on critical questions with actual development. (For a more detailed explanation of this strategy see the article by Borg.[25]) The questions asked in this research problem were: What is the relationship between the type of job function and the type of information needed? What is the relationship between where a decision-maker is in the decision phase and the

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[25]Walter R. Borg, "The Balance Between Educational Research and Development: A Question of Strategy," Educational Technology, VI, No. 7 (1969, pp. 5-11.

type of information needed? And, what is the interrelationship, if any, between job function and decision phase in terms of information needed? Stated more simply, we guessed that if a decision-maker was a superintendent of schools he had different information needs than a teacher; we also guessed that if a decision-maker was just beginning the process of looking for new ideas he had different information needs than someone close to the final decision point; we also wondered if there was any interaction between these two variables.

To test our ideas, we used the same subjects involved in the preliminary field test. At the 9:00 a.m. meeting on May 16 we asked them to take a pretest. The test included a number of questions a decision-maker might ask about educational development (e.g., "Does this program have explicit, clearly stated goals?" or "Is openness to new ideas or other personality styles essential for teachers?"). The instrument was pretested before use in the field test. The questions were grouped into nine classes or types of information. The subjects were requested to respond to each item in terms of how important the information was to a specific time in his decision-making. The subjects were divided randomly into two groups by job classification. One group was instructed to evaluate their information needs as though they were "searching for something better"; the remaining half completed the form with the instruction that they had narrowed their choice to one alternative and were "planning for trial adoption." At the 2:30 p.m. session the same questionnaire was administered and the directions were switched for the two groups. The design for data analysis involved the use of Lindquist's Type

IV design.[26] Results indicated no relationship between decision "set" and job classification. There were significant interactions between decision-making set and subjects and between item class by person. The decision set by item class was not significant. The conclusion was that "there is no evidence of a difference in the overall value assigned in the two decision sets [but that] there is clearly a difference in the value or importance assigned to different classes of information."[27] In short, there were large individual differences which obscure any difference in job or exposure to curriculum information. Item analysis suggested that most information items are more important when the set is "planning for adoption" than when "searching for something better." The item analysis also revealed that the nine information classes could be rank ordered, and, although the differences among the classes were not large, they were consistently larger than variances within classes. The results of this small research project led the staff to conclude that it would be fruitless to concentrate on differences in terms of types of information required at different points along a decision continuum until better measures of controlling or predicting individual differences could be achieved. It was also concluded that organizing the information unit for groups of people at different job classifications was not warranted.

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[26]E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston: Houghton Mifflin Co., 1953), pp. 285 ff.

[27]Paul D. Hood, "The Perceived Need for Information About Education Developments" (unpublished paper, Far West Laboratory for Educational Research and Development, 1969).

It was also decided that in the main field test focus would be placed on trying to identify variables from which individual differences might be predicted.

Personnel. The staff that had been used for the planning and conceptual stages continued with the project during the preliminary stage. A project director was hired. Holding a Ph.D., he had experience in communications research, mass media, and instructional technology. An additional person with an M.A. was added with a teaching (foreign language) background.

Time and Costs. The preliminary form of the information unit was developed and field tested between December of 1967 and May of 1968. The total costs for this stage were approximately $45,000. A more detailed breakdown of this cost follows:

Consultant Review	$ 1,300
Information Collecting	4,000
Planning	1,000
Developing and Form	25,500
Testing and Data Analysis	4,500
Reporting (on the testing)	700
Overhead[28]	8,000
Total	$45,000

The personnel costs represented 49% of this figure.[29] Film and other media supply costs were $11,500, including an $8,500 subcontract for one film.

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[28]Overhead included all Laboratory Management support but does not include such indirect costs as rent, utilities, communications, etc. These indirect costs are prorated across the various tasks.

[29]Personnel costs include salaries, wages and benefits of all permanent, part-time, and consultant staff.

STAGES OF DEVELOPMENT

Stage 3: The Development and Field Testing of the Main Form

Purposes of this stage. After the conclusion of the preliminary field test, the product was completely developed in its "main form." After development, it was field tested. The Laboratory's description of these two phases of Stage 3 are as follows:

> [In the first phase], preliminary product revision, any necessary changes to insure the effective use of the product in actual school use are made. Decisions about the changes to be made are based on the evaluation judgments and suggestions made by non-Laboratory participants and the experiences and observations of the staff in the preliminary testing stage. Occasionally, these revisions may be so extensive that they amount to a virtual redesign of the product so that a second preliminary field test is necessary.
>
> [In the second phase], main field testing, the product is tested, using larger samples of representatives of the intended audience in actual working situations. The evaluation is conducted quite systematically and is designed primarily to provide information on the product's effectiveness in achieving the stated objectives. The main field test is also used to identify ways in which parts of the product might be improved. Generally the staff responsible for the development of the product is actively involved in the field test as observers of the process and as coordinators of the field-testing activities of the participants. An additional purpose of this main field test is to identify points at which the users of the products need more, or more specific, directions for product use to insure its effectiveness. Following the main field test, decisions are made about possible modifications of the product necessary to correct any deficiencies identified during the evaluation. If the revisions in the product which are made [at this phase] are quite extensive, the main field test may be subsequently repeated to determine the effectiveness of the revised product.[30]

The case study of the Elementary Science Information Unit at the "main form" stage continues under the following headings: Contacts with Developers,

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[30]Far West Laboratory for Educational Research and Development, Contractor's Request.

Development of a Test Plan, Development of the Components, Testing, Evaluation, Conclusions, Personnel, and Costs.

Contacts with developers. Drafts of all the materials developed at the preliminary stage were sent to the respective science project directors for comments. New information about the programs continued to come in. It was clear that one of the major problems was that the science programs had all undergone major changes requiring redrafting the reports.

By this time, the developers were much more cooperative. Though they may not have fully understood or agreed with the objectives of the project, they could now see that the information released would be of a significant nature and so they were willing to provide help.

Development of a test plan. Since detailed testing of the product is the key feature of this stage of development, a major plan for field testing was devised. This plan included a detailed specification of objectives, the design of instruments that would be used, and a test administration plan.

The objectives were classed into three groups (decision objectives, information objectives, affective objectives). General goals were translated into statements of user performance; conditions were specified and standards set. An abridged statement of these objectives follows this paragraph. It should be noted that one objective that might have been used--the number of adoptions made as a result of the use of the information unit--was not used. The rationale for this exclusion was s that a well-informed user might choose not to adopt any of the programs; all of them might fail to meet his objectives and constraints. To require the information unit to effect adoptions would be to confound the quality and nature of the innovations themselves with the information unit. As indicated earlier, the goal of the information unit was to induce rational decision-making--not adoption of new science programs.

1. DECISION OBJECTIVES: (Does the Information Unit enable school personnel to make decisions they find acceptable?)
   a. Having used the Information Unit, subjects will rate each program on a seven-point scale according to the degree that it fits their goals and resources. Over 80% of all subjects will be able to do this under "performance" conditions.
   b. Having used the Information Unit, subjects will indicate which of the programs their schools would consider for adoption. Over 50% of the subjects will make definite decisions adopting or rejecting all programs under "operational" conditions.
   c. Having used the Information Unit, subjects will not indicate: (1) they did not need the Information Unit, or (2) they would be unable to make a decision because their goals were unclear or because they would need to check on the accuracy of the information in the Information Unit. Instead, they will indicate that the Information Unit helped them either make a decision or narrow their choice to one or two programs. Over 60% of the subjects will check the positive "decision" categories from a multiple check list provided under "operational" conditions.
2. INFORMATION OBJECTIVES: (Does the Information Unit impart the basic information needed to make decisions?)
   a. After using the Information Unit, subjects will not indicate the need for any additional information on any of the programs.
   b. After using the Information Unit, subjects will show a statistically significant (.05) increase in their own estimates of their knowledge about the various programs.
   c. After using the Information Unit under "performance" conditions, subjects will correctly match statements about the programs with the names of programs. Eighty percent of the subjects will correctly match items they consider important in making an evaluation of the programs.
3. AFFECTIVE OBJECTIVES: (Do the users like the Information Unit, find it useful, prefer it to other sources of information, and would they use it again or recommend it to others?)
   a. Given an attitude questionnaire (semantic differential format) after using the Information Unit, subjects will express a positive attitude toward the Information Unit on scales such as "useful, interesting, satisfactory, complete, reliable, easy to use, well-organized, and clear." The mean average for all subjects will be 4.0 or better (7.0 being the positive end of the scale).
   b. Given a list of possible primary and secondary sources of information about new science programs, after using the Information Unit, subjects will indicate the Information Unit is superior to all secondary sources. Sixty percent of the subjects would rate the Information Unit above all secondary sources.[31]

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[31]Hutchins, op. cit.

(A description of the procedures used to select subjects and details of the test administration are found below under "testing.")

Development of the components. Between June 1968 and December 1968 the main form of the information unit was developed. This form consisted of the following elements:

Level I: The Overview film which was commissioned for the preliminary field test but which was not delivered on time became available for the main form. During the actual field testing, however, it became clear that the film was quite unsuccessful: viewers seemed antagonized by some of the material and affective evaluation data indicated that the film was falling far below the standards set for it. In retrospect, the problem was caused by the low quality film production and an apparent oversimplification of the problems of science education. The staff believed that continued use of the film in the testing program might lower the results of the overall product and damage the Laboratory's reputation with the schools involved. The film was, therefore, dropped from the main form. Fortunately there was enough time to develop an alternative print form, a booklet divided into two sections: "A User Guide" and "General Summary." The first section replaced the film's instructions on how to use the information unit and the summary presented a discussion of the trends of the new programs in a form modified from the film presentation.

The changes which occured in the product at Level I during this field test provide a good example of the problems confronting a developmental effort that require strategies different from those of research programs. In a research design the changing of the "treatment" halfway through the test would be unacceptable. However, adherence to strict research

methodology could not be followed in a development project because of the constraint of using voluntary field test subjects in "real" situations and because of the costs. Fortunately with a phased test administration (not all tests were conducted at the same time) and a continuous monitoring of the results at each site, improvements in the product could be made as the testing program went along. The problem is similar to the one faced by any curriculum development: because the testing situation is "real" and students are dependent upon the program for instruction, changes must be made as better methods become known or deficiencies identified.

Level II: The media forms of the intermediate level of the information unit continued to be varied during the main form. The briefing on Science--A Process Approach was still a black and white film. The slide presentation of the Inquiry Development Program used in the preliminary form was changed to a film. It is worth noting that this film form was somewhat experimental; it might have been better called a "filmograph" technique. Although the release form was 16mm color film, the photography involved a combination of original 16mm color "action" footage and prints of 16mm color slides shot on the same location. During the field tests few subjects could detect that this was not the usual, complete 16mm film; only media experts noticed the difference. The result was a considerable saving in dollars. A complete 20-minute, color film shot on color film stock would have cost ten to twenty thousand dollars. (A thousand dollars a running minute is a rough index of the cost for a typical educational film.) The IDP film cost about $5,000. The Science Curriculum Improvement Study slide/tape was converted from cartoons to "real" pictures of classroom settings. This change resulted from a number of comments about the unsuitability of the cartoons

in the preliminary field version. Although these comments did not come from a majority of the test subjects, the staff felt it would be better to go to a form that was acceptable to all of the subjects. The Elementary Science Study was also presented in slide/tape format. No audiovisual presentation on the Minnesota Mathematics and Science Teaching Project was available. An attempt had been made to shoot some original stock which could be used in a filmographic approach for MINNEMAST, but because of the location of the shooting (Minnesota), the laboratory staff did not have tight control over its quality. The problem was further complicated by the uncertainty about the continued funding of the MINNEMAST project. It was therefore decided to include only the written report on MINNEMAST at this stage.

Level III and IV: Levels III and IV were combined (background material was inserted as an appendix into the reports). Reports were revised to make them less wordy. A slightly modified organization was adopted to conform to suggestions picked up during the preliminary field tests. The chapter organization of the main form of the reports was as follows:

Organizational Background
Theoretical Background
Content/Materials/Organization
Teaching/Learning Strategy
Implementation
Evaluation

A photograph of the elements of the Elementary Science Information Unit in its main form appears in figure 5.

Figure 5
The Main Form of the Elementary Science Information Unit

Testing. A relatively rigorous site selection procedure was used. A randomly selected sample of one-fourth of all the elementary school superintendents in the public and private schools in Northern California and Nevada were invited to participate in the field test. Schools responding were divided into four groups based upon two types of conditions for two variables that were thought to influence the performance of the information unit. One variable was whether or not the schools were obliged by state law to use a specific text for elementary science (California has such a law, Nevada does not) and the other variable was the degree to which the geographic and demographic characteristics of the site suggested it was "remote" as opposed to being an area where communication was "maximum." Remoteness was defined in terms of distance from an urban center and from a college or university. Twice as many urban as rural sites were selected to correspond to the true ratio of these characteristics in the area covered.

It was estimated in advance that an average of seven subjects would be involved at each site. The table below describes the relation of subjects to sites as they were to be distributed.

MAIN FIELD TEST SITE SELECTION PLAN

	URBAN "Communication Maximum"		RURAL "Communication Minimum"	
	State Text Required	State Text Not Required	State Text Required	State Text Not Required
No. of Sites	6	6	3	3
No. of Respondents	42	42	21	21

During actual field testing, 19 sites and a total of 181 subjects became involved. The additional school and subjects were added because one school which we originally thought would participate, backed out; a substitute was selected and the original school then asked to be included. The exact number of subjects also varied because we could not control the number of subjects each superintendent selected at each site. The subjects included 134 elementary teachers, 28 administrators, 9 curriculum consultants, 3 lay advisory people, 2 secondary teachers, and 5 individuals who classified themselves into more than one of those categories. One hundred twenty-eight subjects were from California Public Schools, 10 were from California Private Schools, and 42 were from Nevada Public Schools (one respondent was unidentified). Eleven subjects were from isolated (rural) schools; 169 were from non-isolated (urban) settings.

Evaluation. In order to allow the reader to compare the results of the main test with the results of the operational field test, presentation of results has been omitted here and the data is reported in a coordinated fashion in the "evaluation" section of the chapter entitled: "Stage 4: The Development and Field Testing of the Operational Form." (See page 49)

Conclusions. The general conclusion reached by the staff as a result of the main field test was that the information unit had met all of its objectives satisfactorily except in the area of knowledge retention. With hindsight the staff recognized that part of this failure was due to inadequate control over the amount of time spent reading the detailed reports. Since this control could not be enforced during the operational testing or in final release, it was decided to place more emphasis in the Level I material on those items of information that were thought to be most critical. Several field test subjects suggested that this might be accomplished with more

chart-like analyses. It was also clear from the staff observation of the field tests that the printed Level I material did not work well in group settings. It was thought that audiovisual materials should be re-developed at this level. (The original decision to drop audiovisual at this level was based on the poor performance of the film that had been developed, not any inherent difficulties in the medium.)

Analysis of the results of the Level II audiovisual briefings revealed no differences in attitude, decision-making function, or information capacity of the filmed briefings as compared to the slide/tape ones. Given the difference in cost between the two, it was therefore decided to go with the slide/tape format, later converted to filmstrips. This was probably the most important physical change in the model that occurred anywhere along the developmental cycle.

During the time that passed between the drafting of the main form reports and the scheduled date of the operational field test, it also became known that revisions in the reports would be necessary to make them accurate. A detailed analysis of the value placed on sections of the reports also revealed that the "historical background" section was least important and so it was placed at the end of the report rather than at the beginning.

Personnel. The personnel involved in this stage remained the same as at the preliminary stage, with these exceptions: one clerk typist was added to the staff to handle the additional level of paper flow in making revisions in reports, and the audiovisual-production staff of the Laboratory was used heavily to produce the audiovisual components of the package after project staff drafted scripts.

Time and Costs. The development and testing of the main form took place between June, 1968 and February of 1969. The total costs for this activity were $46,200. A breakdown of the costs is as follows:

Revising and Developing the Form	$19,000
Field Testing and Data Analysis	19,000
Report Preparation	700
Overhead	7,500
Total	$46,200

Personnel costs represented 49% of this amount. Media production costs were approximately $6,000.

STAGES OF DEVELOPMENT

Stage 4: The Development and Field Testing of the Operational Form

Purpose of this stage. As defined by the Laboratory, the next phases of development include:

> Main product revision, which usually involves minor modification of the product and the development of auxiliary materials necessary to insure that the product will be entirely self-sufficient when put in operational use. As noted above, occasionally the product revisions are so extensive that a second main product test . . . has to be conducted.
>
> [And,] operational product testing, the materials and processes which constitute the product are tested in actual use in classroom or school situations without the participation of the staff responsible for the product's development; that is, the product is tested in the completely realistic setting for which it is ultimately intended. The primary purpose of the operational test is to determine if the product can be used widely in schools without the active intervention or participation of the staff. This phase is crucial in the development and definition of a product of the Laboratory. The Laboratory cannot and does not wish to provide a service function in connection with its products. Rather, the goal of the Laboratory is to produce completed products which have been thoroughly tested for use by school personnel without any active participation by the Laboratory staff.[32]

The following section will discuss these phases under the headings: contacts with the developer, development of a test plan, development of components, testing, evaluation, conclusions, personnel, time and costs.

Contacts with the developers. As the project continued, the cooperation of the developers grew. It was at this phase that one of the developers called, after receiving a revised draft of a report and viewing a filmstrip, to say that the Laboratory staff had done a better job explaining his project than his own staff. Similar comments were made by other developers and to

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[32]Far West Laboratory for Educational Research and Development, Contractor's Request.

date three of the five projects have requested permission to use the Laboratory's copyrighted material in their dissemination effort. (Permission has been refused, to maintain the integrity of the information unit as a decision-oriented package describing all the programs.)

Development of a test plan. The objectives of the information unit remained unchanged throughout this stage. Particular emphasis was placed on the terminal objectives (decision-making), the affective objectives, and data about the use of the unit under operational conditions. Instruments similar to those used in the main field test were retained. No detailed sampling plan was specified.

Development of Components.

Level I: The "User Guide and General Summary" was revised according to the decisions made at the conclusion of the main field test. They were renamed "The Screening Guide" and the "Guide to the Selection of an Elementary Science Curriculum." These were printed as separate booklets. In addition, an audiovisual filmstrip/tape "Preface" was developed for the operational form according to the decisions discussed in the "conclusion" section of the main stage of development.

Level II: All of the audio briefings were converted to filmstrip/tape. Careful examination of the distribution problems convinced the staff that circulating slide sets was very cumbersome and likely to produce problems in operational use.

Level III: (Level IV--was dropped; essential elements were spread throughout other levels of the product.) The reports were revised again and the chapter headings reordered (historical background section last, goals and objectives first) and their names altered.

A box design for the unit was developed and executed.

A photograph of the operational version appears in figure 6.

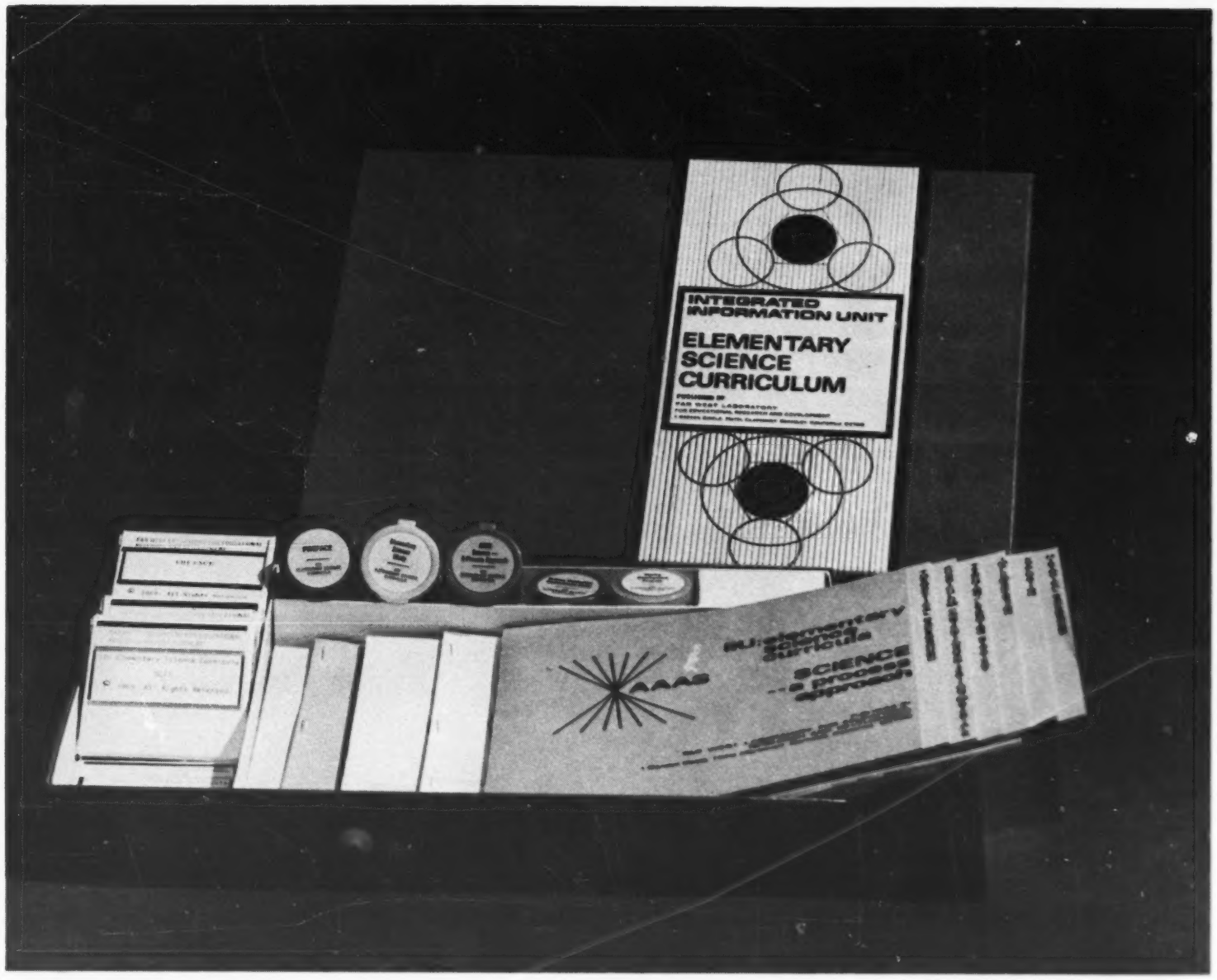

Figure 6
The Operational Form of the Elementary Science Information Unit

Testing. The sample for this field test was not drawn as rigorously as the main field test sample since no significant basis could be found for distinctions between sites of different characteristics. Sites expressing interest in the project were contacted by letter and asked to use and evaluate the operational field test (OFT) version. (Most of these expressions of interest were obtained while selecting main field test sites.) Sites were selected to represent different geographic characteristics and a variety of uses. Approximately one-third of the sites was drawn from the St. Louis area through the cooperation of the Central Midwestern Regional Educational Laboratory in St. Ann. All other sites were in the geographic area covered by the Laboratory.

As much as possible, only sites designating themselves as actively involved in the review and evaluation of innovative alternatives in science education were selected. No restrictions on the selection of participants were set, but all sites submitted data indicating the positions of those involved and the review procedure(s) followed.

At each site, one participant completed the questionnaire for the group involved in reviewing the package. Thus, for 24 groups, a total of 24 respondents (teachers, principals, central office staff, teachers in training, professors, and researchers) completed the field test instrument.

The coordinator at each site was required to answer a three page questionnaire when the use of the information unit was complete. In addition the coordinator at all sites within the Laboratory's region and those schools cooperating from the St. Louis area met with a Laboratory staff member for an hour interview and responded to questions contained in an interview guideline. The questionnaire included questions asked during the main field test to test decision, information, and attitude objectives for the information

unit. In addition, respondents were asked to describe how they used the product and to indicate various reactions to it. (Complete copies of the instruments can be had on request.)

No direct controls over the use of the materials were exercised. All groups were mailed one copy of the information package for use during the months of May and June, 1969, and asked to use it in a way suitable to their needs.

The only restriction placed on the use of the box was that each site was limited to a one-month use and agreed to provide feedback data after using the package. The first "test" of the package was whether sites would return it unused at the end of the time period. This did not happen; all participating groups made use of the information unit. By itself, the use of the information unit by all users is a significant piece of evaluation information.

Evaluation. Results of the operational field test are reported below as abstracted from the final report of the product development cycle.[33] For the reader's convenience, the comparable data from the main field test ("performance field test"--PFT) has also been included.

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[33]Hutchins, op. cit.

1. DECISION OBJECTIVES: Does the IU (information unit) enable school personnel to make decisions they find acceptable? The field tests indicate that it does. The performances that were required during the various tests and the results of this testing are as follows:

a. Having used the IU, subjects will rate each IU program reviewed (SCIS, ESS, etc.) on a seven-point scale according to the degree that fits their goals and resources. They will not indicate they have insufficient information. During the Main Field Test (MFT) 87% of all subjects were able to do this on all programs. [See Table 2.]

b. Having used the IU, subjects will indicate which of the programs their schools would consider for adoption. During the Operational Field Test (OFT) over 57% of the subjects (the percentage ranged as high as 87% for one particular program) made "adoption-rejection" decisions on all programs. [See Table 2.]

c. Having used the IU, subjects will <u>not</u> indicate that they did not need the IU, or would be unable to make a decision because their goals were unclear or because they would need to check on the accuracy of the information in the IU. Instead, they will indicate that the IU helped them either make a decision or narrow their choice to one or two programs. During the MFT, 58% of the subjects checked the positive "decision" categories from a multiple check list. During the OFT, 63% of the subjects followed suit. [See Table 3.]

In short, it appears that the majority of all the test respondents could make satisfactory decisions with the IU.

2. INFORMATION OBJECTIVES: Does the IU impart the basic information needed to make such decisions? The answers to this question are conflicting. On the one hand, subjects were asked if any information they needed to make decisions was not supplied. Almost no one indicated the need for additional information (less than 5%). When such a need was expressed, it was usually for information that was omitted from the IU because it was not available (but would be included later) or because the constraints of development had set it outside the boundaries of what was to be included--such as information from "early adopters."

TABLE 2

This table presents the percentages of the operational field test respondents who made definite commitments about their choice of programs and the percentage of the main field test participants who were asked to make judgments about the "fit" of each program to their own school's goals and resources. (Clearly, the former is a more "difficult" item.)

	MAIN FIELD TEST (n = 124-128)		OPERATIONAL FIELD TEST (n = 23)	
Program	% PFT "Matching"	% Checking Insufficient Information	% OFT Judgments Made	% of Non-Response
SCIS	93%	7%	57%	43%
S--APA	87	13	78	22
IDP	91	9	87	13
ESS	94	6	65	35

Table 2 suggests that while most operational field test respondents could make a judgment about how their schools would feel about each program, they were more reluctant to make a definite or precise judgment than main field test participants to estimate the "fit" of the program.

TABLE 3

	Main Field Test (n = 138)	Operational Field Test (n = 24)
(a) Because of my previous knowledge and experience, I do not believe the IU would be of significant use in selecting a program.	1%	13%
(b) I already had a pretty firm idea about the program I would pick and would not have needed the IU.	1	8
(c) I am not ready to make a decision at this time; our objectives must be more clearly defined.	24	4
(d) Before I would make such a decision, I would want to do my own checking on the information presented in the IU.	12	4
(e) *The IU enabled me to decide that none of the programs (including the one I am now using) is satisfactory and I will continue to look for another one.	0	0
(f) *The IU helped me narrow my choice down to one or two programs on which I would want more information.	45	42
(g) *The IU was of definite help; on the basis of the information supplied, I would be able to pick a program to fit my needs.	13	21
(h) The IU was of definite help in some other way. (Please specify:	4	8
* = positive "decision categories", total:	58%	63%

It is noteworthy that operational field test respondents are more "ready" than main field test participants to use the IU for decision-making [re: alternative (c)] and have high confidence in the information provided [re: alternative (d)].

In contrast, however, they are initially more informed and therefore less in need of the IU than performance field test participants [re: alternatives (a) and (b)]. In part, the staff attributes some of this increase to the use of a single respondent summarizing the conclusions of the larger group of subjects rather than the completion of each questionnaire by all subjects. The respondent selected by the school usually was the best informed in the school and because of the use of the personal pronoun "I" in the questionnaire, he had a tendency to answer for himself on this item rather than considering the whole group. Though the same response set would be equally applicable to other items, it is this item where he was most likely to differ from the group.

Further, in a supplementary study by Hood and Hutchins (1969),[34] it was shown rather conclusively that the IU did result in statistically significant increases in the users' own estimates of their knowledge about the various programs. This study was a supplement to the main field test. Pre-post conditions prevailed, but subjects were volunteers and no method of random assignment of subjects to "treatment" and "control" conditions was possible.

In contrast, however, when an instrument requiring subjects to match statements about each program with the names of the program (a posttest only for the MFT) only about a third of the subjects could pass more than half of the items. [See Table 4.] Since subjects were able to skip items that called for information that they thought unimportant, it seems relatively clear that not as much information could be recalled by the subjects as either the staff or the subjects thought should be recalled. Why? One reason is probably that subjects did not spend as much time with the Reports as they had been asked to. The other and more obvious conclusion is simply that the IU was not working as well as had been hoped.

One of the reasons that users did not spend enough time with each booklet was that they are unwilling to reduce the number of programs they continued to consider after each level of the IU; therefore they spent less of their limited time with each program. This is an important variation from the intended three-level model of the IU. After viewing or reading each level, the user was supposed to eliminate programs so that by the time he arrived at level three (the Reports) he would have narrowed his choice to one or two programs that could be studied in depth. In fact, users were reluctant to follow this pattern. Apparently they

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[34]Paul D. Hood and C. L. Hutchins, Measuring the Effect and Value of Information about Educational Alternatives: An Experimental Study (Berkeley: Far West Laboratory for Educational Research and Development, 1969).

TABLE 4

Percents and Cumulative Percents of Respondents
Receiving scores from 0% to 100% on knowledge retention items.
Score = # correct ÷ (# correct + # incorrect)

Scores (% Correct)	Percent Respondents	Cumulative % Respondents
100%	0%	0%
90-99%	0%	0%
80-89%	1%	1%
70-79%	3%	4%
60-69%	12%	16%
50-59%	13%	29%
40-49%	13%	42%
30-39%	17%	59%
20-29%	13%	72%
10-19%	16%	88%
1-9%	10%	98%
0%	2%	100%

felt obliged to look at all programs--so long as the total number to be considered remains within a manageable limit. (Experience with other IU's and discussions with users has led the staff to conclude that when the total number of programs exceeds that 5-7 range, the user is prepared to narrow his choices earlier in the selection processes to a smaller number (2 or 3) than he will if he thinks himself capable of fully considering the total number initially presented to him.) Much of this is speculation, however, and all that can be definitely concluded is that while the information objectives of the IU are not being met as successfully as initially hoped, they are being met in part.

3. ATTITUDE OBJECTIVES: Do the users like the IU, find it useful, prefer it to other sources of information, and would they use it again or recommend it to others? The answers to these questions speak positively for the value of the IU.

a. Given semantic differential instrument after using the IU, subjects shall express a positive attitude toward the IU on scales such as "useful, interesting, satisfactory, complete, reliable, easy to use, well organized, and clear." On the MFT all subjects averaged over 4.8, on all parts of the IU, on a seven-point scale (seven being the positive end). On the OFT subjects averaged over 5.9. [See Table 5.]

b. Given a list of possible sources of information for getting adequate information about new science programs, subjects will indicate that the IU is among the most desirable sources. On both the MFT and the OFT the IU was ranked or rated above "hiring consultants, professional meetings or conventions, contacts with publishers and product developers, and reading professional journals." It was ranked below "workshops using the new science curriculum materials, and site visits to innovative projects." On the MFT it was ranked below "conversations with professionals whose judgments I value"; on the OFT it ranked above the same item. In other words, the IU is ranked above all other secondary sources and rated below interpersonal contacts. [See Table 6.]

c. As to whether subjects would use the IU again, only two of the 24 OFT respondents indicated they would not request the IU and one of those said he would request an IU in another field (since he presumably got what he wanted out of the present IU). All the OFT respondents said they would request an IU in other fields if they were available.

Clearly, the IU has met with a favorable reaction from users.

4. OTHER RELEVANT INFORMATION: In addition to the other evidence presented, the following pieces of information seem relevant to an evaluation of the IU:

TABLE 5

Mean Scores Over Each of the Nine Scales
for Both the Main and the Operational Field Test

Scale	IU MFT	IU OFT
Interesting	5.7	6.1
Satisfactory	5.2	5.9
Sufficient	4.7	5.4
Complete	4.3	5.2
Reliable	5.3	6.0
Easy to Use	4.9	6.4
Well-organized	3.2	6.4
Clear	4.7	6.0
Useful	5.6	5.6

TABLE 6

Source	Usefulness Rating/Rank: Main Field Test (n = 131-141) Rating	Rank	Operational Field Test (n = 24) Rating	Rank
Workshops using new science curriculum materials	6.50	1	6.50	1
Site visits to innovative projects	6.21	2	5.75	3
Pilot projects in own district	6.13	3	6.00	2
Conversations with professionals whose judgment I value	5.97	4	5.58	5-6
Information Unit	5.63	5	5.61	4
Hiring of consultants	5.05	6	5.04	8
Professional conventions or meetings	4.97	7	5.58	5-6
Contacts with publishers and product developers	4.76	8	5.08	7
Reading of professional journals	4.74	9	4.21	9

Another way to treat the operational data is to look beyond "usefulness" ratings and consider a "consensus" score or the degree of agreement among respondents regarding sources they would prefer to the IU. On the basis of the number of respondents who place a source either "before" or "after" the IU in regard to its usefulness for curriculum decision-making, we can compute an algebraic score for a source which more precisely locates it in relation to the IU. Each operational field test respondent indicated which of the sources was more valuable to him than the IU. Whenever a source was pointed out as more valuable, we gave it a score of +1; otherwise, it was given a score of -1. The sum of scores for each source (over the 24 respondents) is a positive or negative value, depending on whether more respondents like it better or not as well as the IU. The following exhibit presents the results of such analysis on the operational field test data:

+25
20
15
10 -- Workshops using new science curriculum materials
5
-- Pilot projects
0 -- IU
-- Site visits
-5
-10
-- Contacts with publishers and product developers
-- Conversations with professionals whose judgment I value;
-15 Hiring of consultants
-20 -- Professional conventions or meetings
-25

This gives us quite a different picture of the IU in relation to these other sources. In terms of this "consensus" measure, only workshops are markedly more valuable than the IU for curriculum decisions. Pilot projects and site visits are preferred about as often as the IU. Developers' reports, consultants, and interpersonal conversation are not as often preferred, and meetings and journals are rarely preferred.

a. All OFT respondents indicated that they believe the Laboratory had given a fair review of the programs.

b. When asked how much they would pay for renting the IU, 6 OFT subjects indicated they would pay $50 for a month's rental, 5 said they would pay $25 and 4 said they would pay $10. Twelve of the fifteen OFT respondents said they would pay $15 for one week with the option of extending it to a month for $25. In order to buy the IU 6 respondents (of 13) said they would pay as much as $100; 7 said they would pay around $50. Overall, 10 respondents would prefer to rent, 9 would prefer purchasing a permanent copy. (The final selling price was $75; no rental plan was available.)

c. OFT respondents preferred a noncommercial publisher or at least one not involved with any of the programs.

d. It seems probable that at least one-fourth of the secondary target audience for the IU (schools of education, state departments of education, and other linking agents to the schools) will be willing to purchase the IU.

e. The primary use of the IU outside the field testing situations has been as "an information source" or preservice tool rather than as a decision-making tool. (Out of 133 users of the IU since the completion of the OFT, 64 have used it "for information," 26 as a preservice tool, 19 as an inservice tool, and 14 as a decision-making tool.)

f. University professors using the IU with their science education classes have been unanimous in their positive reaction to the IU.

g. As of December, 1969, the Elementary Science IU has been tested or used in 33 states and 2 foreign countries. It has been seen or used by over 5,000 people at 91 sites. It has been used in institutions of higher education, in over 75 public and private elementary school districts, and in over 40 R & D laboratories, Title III Centers, and State Departments of Education. During all this time no negative feedback about the purpose or general nature of the IU has been received.

h. In June of 1970 a telephone survey of a random sample of 1/3 of the schools participating in the main and operational field tests was made. The interview focused on gatheringg long range data about the use of the information unit. The results indicated that 50% of the schools used the information to arrive at a "real" decision; the remainder were simply cooperating with the request to field test the unit and had not planned to review their science curriculum that year. Overwhelmingly the unit was rated good or excellent by all users. However in only one situation (out of 20) was the unit <u>alone</u> accorded the primary role in leading to an adoption decision.

Elsewhere, the unit was used with additional information from persons using or familiar with programs. Personal experience and assessment of the program appears to be crucially important in making a decision of such magnitude. However, personal interviews stressed the importance of having information gathered and organized to assist in the decision process as well as to inform teachers in preservice and inservice classes and workshops.

Conclusions. As indicated by the test data reported, the information unit generally met all of its objectives. In summary, the evaluation revealed the following:

- 87% of the subjects could rate each program reviewed in the unit against their goals and objectives to a high degree of confidence.

- 57% (and in some cases many more) of the subjects could indicate which of the programs they would adopt (or recommend for adoption).

- 63% of the subjects indicated that the information unit provided all the information they needed to make an adoption (or rejection) decision.

- Subjects experienced a statistically significant increase in their own estimation of their knowledge about the programs.

- Average ratings by subjects placed the information unit at 5.9 (toward the positive end) on a seven point scale combining such criteria as useful, interesting, satisfactory, complete, reliable, easy to use, well-organized, and clear.

- Given a list of possible resources of curriculum information, subjects indicated that the information unit was far more desirable than all other secondary sources of comparable information (hiring consultants, professional meetings or conventions, and journals) and almost equivalent to all primary sources (workshops using the new science curriculum materials, site visits to innovative projects, and conversations with professionals whose judgments they valued).

The only negative information obtained during the field evaluations of the information unit was that only one-third of the subjects could correctly match the names of the various programs with facts that the staff judged to be important about each program. This low performance may be due to many users not spending as much time with the unit as was desired and having difficulty associating what they remembered about the programs with specific names of the programs (although they could, in general, remember the nature of the programs). Perhaps the more obvious conclusion is that users simply did not remember everything that the staff believed was important to make a "good" decision.

As a result, the staff recommended that the unit be released by the Laboratory. (Certain modifications were also recommended, see below.) The procedure used to secure this release requires that the Director of the Laboratory select a panel to review the product and judge its quality. These judges are drawn from the senior staff of the Laboratory--but outside the program in which the product was developed. This procedure was followed and the product was approved for release.

The changes recommended in the released product form were these (a full rationale for these changes is spelled out in the final product report):

1. It was recommended that one more program should be added to the five described by the information unit: COPES--the Conceptually Oriented Program in Science.

The inclusion of this program after completion of the operational field test was dictated by the request of the American Association for the Advancement of Science that it be included in our treatment of the "new elementary science programs." The existence of COPES was known to the staff throughout the developmental cycle of the unit but it had not been included because it was not as far along in its developmental cycle as the other programs. It seemed clear, however, that it would be completed shortly after the unit was to be released and therefore should be included. It was the opinion of the program staff responsible for the unit that the addition of this program would improve the performance and operation of the product and would not be detrimental as long as the program material was accurate and exactly parallel in form to the material on the other programs.

One other program, "Measure and Find Out," the outcome of a project entitled "The Study of a Quantitative Approach in Elementary School Science,"

might have been included in the final product but was not. The project went out of operation shortly before the developmental cycle of the information unit began, and it was not known until after distribution of the unit had been arranged that this particular science program had been picked up by a commercial publisher for distribution. Omission of this program was not considered critical because it is only a supplementary, one-year science program and does not have the multigrade characteristic of most of the other programs. (In all fairness, it should be pointed out that the same comment can be made about the Inquiry Development Program.) Furthermore, the project is limited to only one scientific process--measuring--and therefore is less comprehensive.

Still other programs might be considered for inclusion, since the enthusiastic reception which the initial group of government-sponsored projects has had among school people has led to a round of new development on the part of the commercial publishing industry. At the conclusion of field trials, however, it seemed justifiable to restrict the package to the early, trend-setting programs that were funded with federal resources. To open the door to a whole range of the more recent programs that have come out of the publishing industry would have delayed the release of the information unit well beyond 1970. Plans are now underway in the Communication Program for a "second-generation information system" which would include the capability of adding new programs to the system as they become operationally available. It is clear that such an updating procedure will be necessary to maintain the long-range effectiveness of the information system.

2. It was recommended that a folder or "Review" be added in five copies. This folder should summarize the information unit for individual users in a group setting. Comments and observations made during the operational field test revealed that users tended to take many notes and were therefore unable to follow the audiovisual elements closely. Providing them with the key information and charts should help them concentrate on the program. Individual users also wanted a "table of contents" for the use of the information unit. The rest of the materials in the "Screening Guide" and "Guide to the Selection of an Elementary Science Curriculum" were placed in a booklet for group leaders who were the only ones that needed much of the detail provided.

3. A "Supplement" sheet was planned for distribution one year after the publication of the information unit--to update it and forestall the need for revision.

4. It was recommended that the audiovisual briefings be reshot to improve their photographic quality and to secure commercial releases from persons shown in the slides.

It was assumed that all these changes would be made by the commercial distributor (an assumption that later proved incorrect).

Personnel. There was no addition to the staff during this period. There was a turnover of one clerk-typist and one research clerk.

Perhaps it should be noted at this point that none of the staff involved in the project were science educators or had a background in science. In fact, with one exception, none of the staff had a public school background. The project found that generalists with a background in communications, journalism, mass media, or some related field were the most valuable. On

two occasions, attempts were made to involve science "experts" in the preparation of some of the materials and in both cases the results were unsatisfactory. This has been the experience of the staff in working on information units in other subjects as well. The problem seems to be that "experts" frequently have biases for one particular philosophy of education; they seldom have an objective view that enables them to write about all projects with equal clarity.

Time and Costs. The operational form was developed and tested between March, 1969 and June, 1969. The total costs for this stage were $47,800. The revision and development costs were $26,000, the field testing and data analysis costs were $14,500 and the overhead costs were $7,300. Of the total $47,800, personnel costs amounted to 56% and about $3,500 was spent on media work.

STAGES OF DEVELOPMENT

Stage 5: The Development of the Release Version, the Planning for Dissemination, and Product Dissemination.

Purpose of this stage. The Laboratory describes the phases of this stage in the following manner:

> Operational product revision, includes the correction of the minor deficiencies discovered in the operational test. It may also include those revisions judged by the potential product distributor as essential for adoption by schools, provided they will not in any way reduce the effectiveness of the product.
>
> Dissemination planning, usually requires widely varying amounts of time and effort depending on the nature of the product; work on this stage often is initiated simultaneously with Stages 5 or 6; and is ordinarily the joint responsibility of the appropriate product-development program staff and the General Dissemination Program staff. The work generally involves identification of and negotiation with an outside distributor for production and distribution of the final product; occasionally it may involve production of the final product by the Laboratory. This phase is terminated after Stage 8 when arrangements for efficient product distribution have been completed.
>
> Product dissemination, is an open ended period during which the developed products are being distributed on a large-scale basis to school users. The General Dissemination Program has almost complete responsibility for this phase, with the product-development staff involved only in a periodic monitoring role to insure that the products are still effective in accomplishing their objectives and that they are generally being used in the way for which they were designed.[35]

It should be noted that at the date of this writing, the Elementary Science Information Unit has just begun the product dissemination phase. As a result, no detailed report of this activity can be made except to note that pre-publication sales of the information unit were approximately 130 at $75 each.

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[35] The Far West Laboratory, Op. Cit.

The chapter will be outlined in the following sections: contacts with publishers, development of the dissemination plan, developing the final form, personnel, time and budget.

Contacts with publishers. Under the general guidelines now used by the Office of Education, it is desirable to involve commercial publishers in the final dissemination of an educational product developed with federal support. Previously, the strategy was to make materials available through the "public domain." In practice, this procedure had prevented the release of most "project curriculum materials." Unless a potential publisher could be assured protection of his investment in the publication and marketing of material, the risks were too great. Under the present policy, copyrights can be granted for five years, hopefully attracting the commercial sphere to products of federally supported efforts and insuring their wider distribution and use.

Accordingly, a general announcement of the availability of Elementary Science Information Unit and a request for proposals (RFP) was made through standard publishing channels. Permission to secure a copyright was also granted by the Office of Education.

During the formal waiting period for the deadline for proposals, three commercial publishers contacted the Laboratory and expressed interest in the product. One non-commercial agent also expressed interest. Detailed information was given to these prospective publishers as provided by the terms of the RFP.

At the conclusion of the formal waiting period, only the non-commercial publisher submitted a proposal. The probably reasons

for disinterest on the part of the commercial publishers (as judged by the staff through informal contacts with the publishers after the deadline for proposals had passed) was that (1) the information unit did not have a high volume sales potential and therefore, (2) profits would not be satisfactory, (3) involvement by a publisher who either had or might have an elementary science program would place him in the position of selling a competitor's product, (4) schools were not accustomed to paying for the type of information contained in the unit and (5) salesmen didn't know how to market it.

After some deliberation, the non-profit publisher's proposal was accepted even though it did not meet all the criteria. In particular, this publisher's financial position was very weak and he had no previous experience in distributing a "package" of the kind involved. Furthermore, his approach was to be "direct mail" since he had no field salesmen.

The only other option the Laboratory had was to publish the product themselves or begin again to look for a commercial publisher. The concern for the time value of the materials ruled out anything that would delay publication. With great hope and a deep breath, negotiations began with the non-commercial publisher.

Midway through this process, which took much longer than the Laboratory had expected (fully one year prior the time original contact was made and negotiations were finally broken off), it became clear that certain conditions separated the two parties. The Laboratory was interested in keeping the price at a reasonable level and the small cash base of the publisher necessitated the production of only a small number of copies, thereby preventing the cost breaks

customary for larger publishing runs.

To keep the price to the user down and circumvent some difficulties that had arisen in contract negotiations, the decision was made that the Laboratory would create the basic inventory of the units and sell them to the publisher on a cash basis. Even this arrangement could not be concluded however, and negotiations were subsequently broken off--with the distributor permitted to complete pre-publication sales he had secured by a direct mail campaign conducted during negotiations.

Steps were then taken to find another publisher/distributor who would handle the Laboratory-produced stock. By informal contacts with other publishers, such an arrangement is now being concluded.

Developments of the dissemination plan. Before contacts with publishers began, a dissemination strategy was adopted. Briefly, the plan called for a "two step-flow" model of dissemination. That is, it was assumed that one of the chief avenues for spreading the use of the information unit was to put it in the hands of "change agents" or "cosmopolitans" who would carry the unit or word of it to local adopters. This plan called for a marketing emphasis on regional and national figures, who were thought to be "influentials" in guiding the public school practice--teachers in well known pre-service, science education programs; consultants who "make the rounds" at conventions; etc.; and professional organizations who hire out on a contract basis to assist schools in planning--all this in addition to direct contact with the primary target of school principals and administrators responsible for organizing and focusing upon local curriculum decisions. If feasible, this plan called for a "training" program for these "influentials"

as well as the repackaging of the information unit for use in pre-service programs. Because of the difficulties of securing a publisher, however, many of the plans have had to be curtailed. It is still hoped they can be activated.

Developing the final form. Prior to the time the formal request for proposals went out to publishers, it was decided to re-shoot the film strips in order to obtain commercial releases from the participants shown on the films. Non-commercial, educational releases had been secured at the time of original shooting, but it was felt that the availability of these non-commercial releases--and not the commercial ones--would put the non-commercial bidders at an advantage in the bidding process. Though this work was relatively expensive, it was believed to be necessary; it also permitted another opportunity to improve the quality of the product. The changes in the text, including the addition of the report and filmstrip on COPES, as recommended by the Laboratory review committee, were also accomplished at this phase.

When it became clear that the Laboratory would actually have to produce the basic stock of information units, this work was also begun. It involved selecting an overall design scheme for the product (an outside design firm was employed), setting the printed material into print, making the master negatives and copies of the film strips, production of the box, and collating. This work was all done under contracts with outside commercial vendors. A picture of the final product is shown in figure 7. Pictures of the components at each of the levels within the information unit are also shown. The levels and the elements within them were:

Introductory materials: a set of instructions for users and group leaders in printed form; a handout (five copies) for individual participants in a group-decision making activity; and a twelve-minute audiovisual introduction intended for large groups (or individuals). (See Figure 8)

Audiovisual briefings: one briefing for each program; the briefings focus on classroom use of the programs. (See Figure 9)

Detail program reports: one report for each program. The sections of the report are: (See Figure 10).

1. Goals and Objectives
2. Content and Materials
3. Classroom strategies and Activities
4. Implementation Requirements
5. Evaluation
6. Project History

Personnel. As already suggested by previous text, a number of additional personnel were necessary to conclude this phase of the development. Legal advisers were used to conduct the contact negotiations, the Laboratory's dissemination coordinator was deeply involved in contacting potential publishers and suggesting patterns for marketing, outside vendors were placed under contract to design the completed form of the information unit, do the page layouts, create the master negatives, make copies, type set, print and bind the booklets, construct the box, and collate. One additional man was required during this period simply to coordinate all of the various details involved. Many of the Laboratory's senior staff were also involved, periodically, as decisions were made in the actual negotiating process.

Figure 7
The Final Release Form of the Elementary Science Information Unit

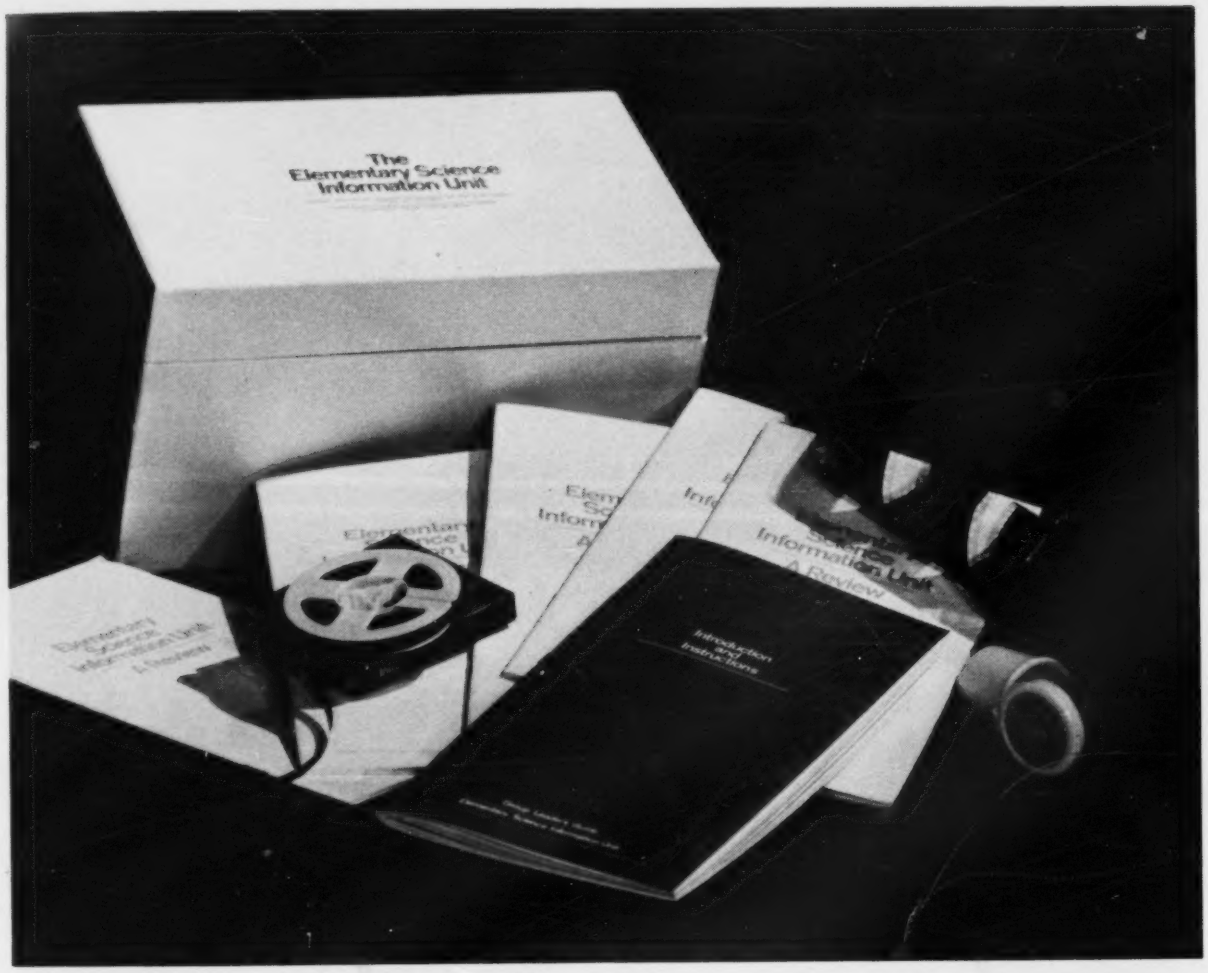

Figure 8
Level I: Introductory Materials of the Final Release Form

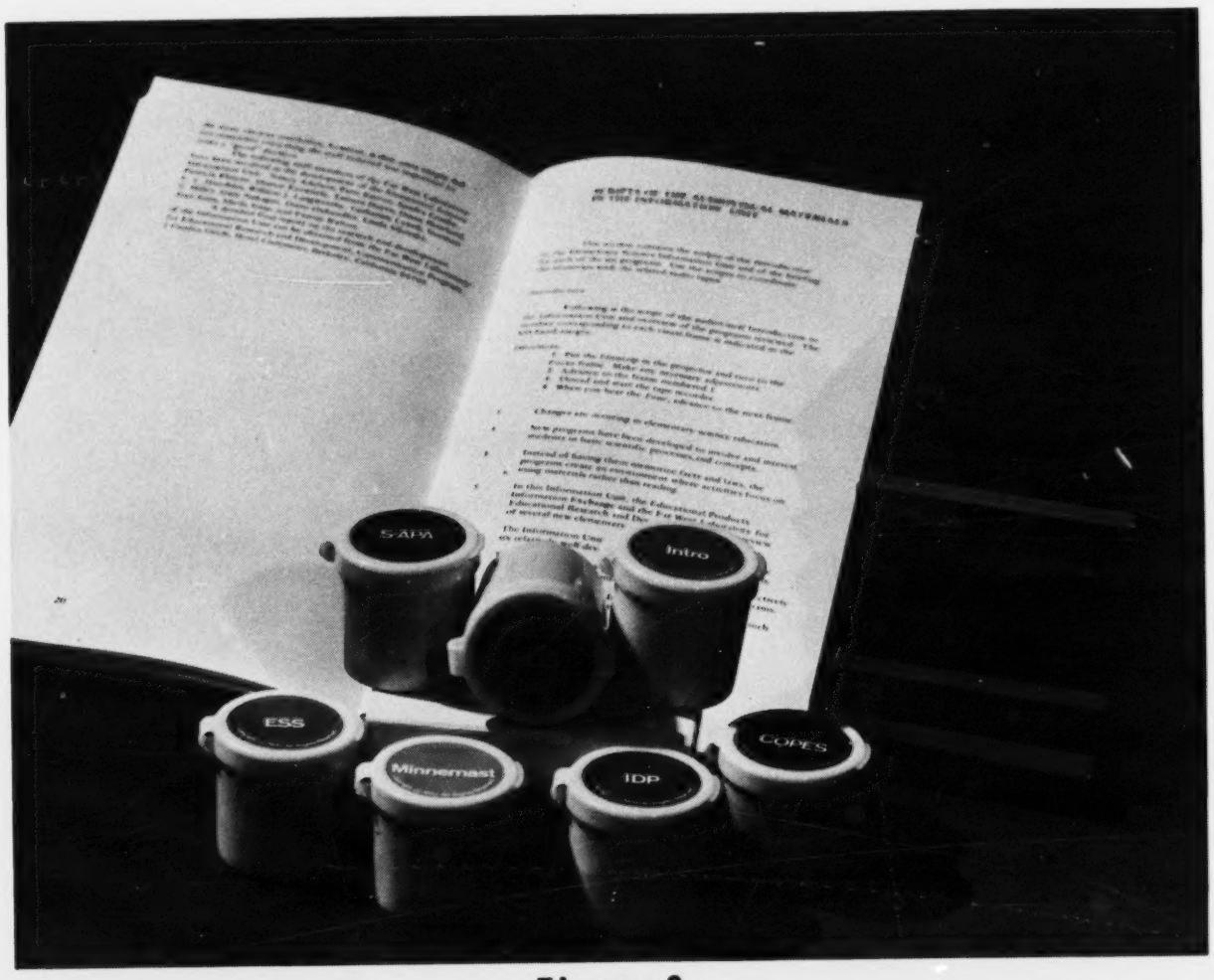

Figure 9

Level II: Intermediate Audiovisual Briefings of the Final Release Form

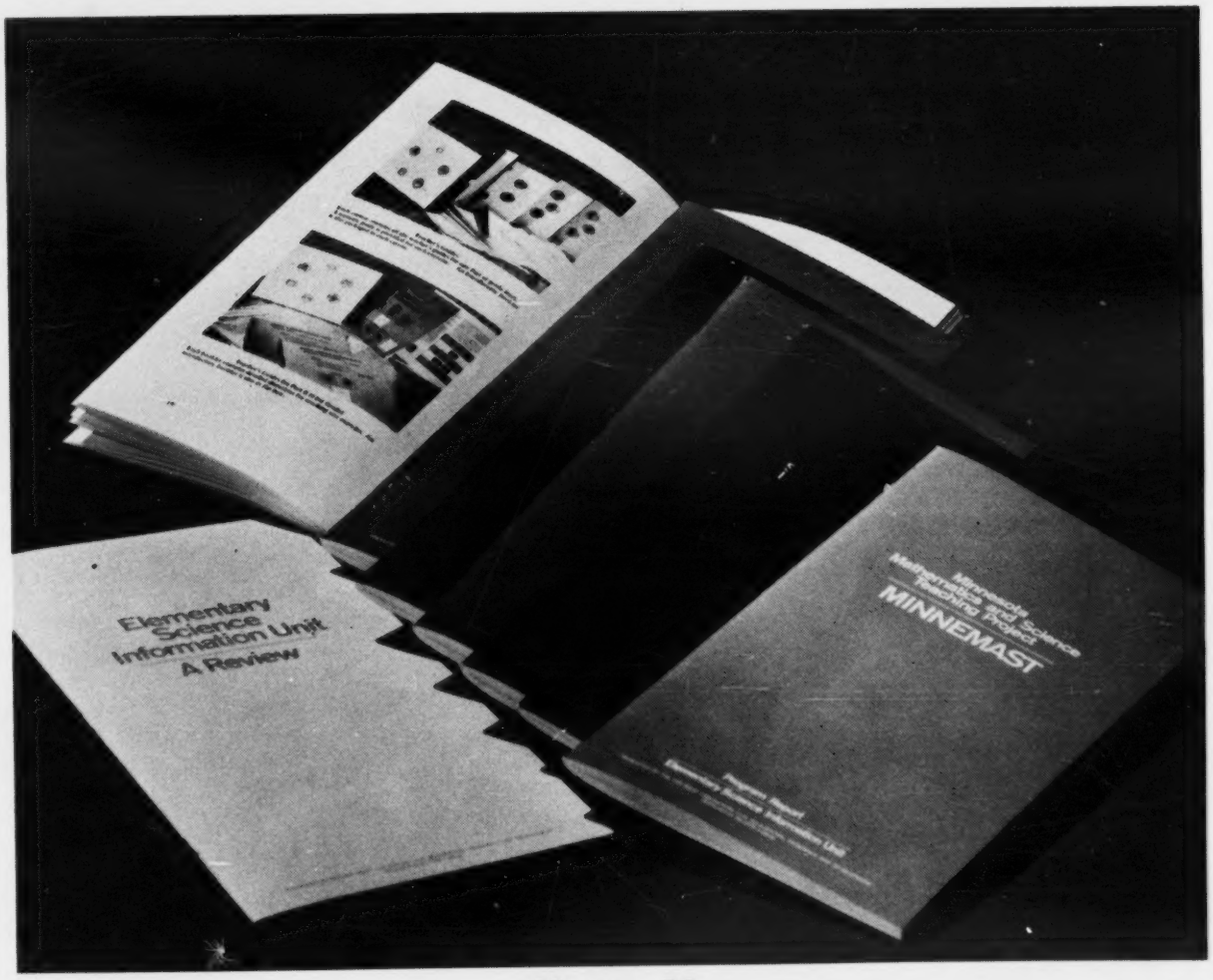

Figure 10

Level III: The Detailed Reports of the Final Release Form

Time and Costs. The development of the final form and dissemination work to date amount to $59,100. A breakdown of this total is as follows:

Final form revision including new information gathering for COPES	$ 47,500
Dissemination planning	2,000
Report preparation	8,000
Staff training (these figures had not been broken out before)	1,600
	$ 59,100

(Overhead was not computed separately at this time.) Of this figure, approximately 61% went for personnel; media costs were $10,000. Not included in the above figure were these additional costs: $33,000 to create the stock of the information units (this money should be replaced as the stock is sold) and an unspecified amount of legal fees; these have not been determined as yet. It should be noted that the costs of this phase would have been considerably less if a satisfactory arrangement with a commercial publisher could have been made. We estimate the cost would have been about $23,000 if such an arrangement could have been made.

CONTINUATION OF THE INFORMATION UNIT PLAN TO OTHER UNITS

One of the emphatic points with which this document should conclude is the idea that the systematic development of a product through the procedures outlined above is an important step toward the development of a generic production system which, in turn, can produce other, similar products. To justify the high costs of initial development of a unit like the one described, it is important to secure a "pay off" or return of investment by applying the procedures, developed through this effort, to the production of similar products. Such was the clear intent of the strategy followed in developing the Elementary Science Information Unit. It was seen simply as a first, full scale prototype of many other information units to come. Detailed records of procedures used were kept and actions were taken to systematically develop a technology that would replicate procedures to produce other information units more economically. This technology is based, among other things, on secondary products such as manuals and training programs for writers and scriptwriters, detailed schemes for curriculum analysis and information collection and processing, and systematic procedures for selecting programs and involving both "expert" consultants from relevant fields as well as members of the target audience.

A separate task for this effort to develop a technology for applying the idea of Elementary Science Information Units to other subject areas. This task was called "system development." Over the period of the three years that the work on the Science Unit was underway, the cost of this effort was $55,000.

In line with this "systems development approach" the effort behind the Elementary Science Information Unit was extended during 1969-70. A substantial savings in dollars should be noted in these further efforts because of the work involved in developing the Science Information Unit.

Finally, the most rewarding "pay off" has come while we worked with the first system--the information unit system described above. As we gained experience and insight into the general applicability of this system and recognized its assets and shortcomings, we have reached the point where our developmental efforts now allow us to go beyond the system for developing information units to a more comprehensive system that uses the best features of the first system, but adds characteristics designed to enhance the overall goals of the program's efforts. Such a system is now under development. It is called ALERT--Alternatives for Learning Through Educational Research and Technology; a detailed plan for development of this system is available from the Laboratory. The document outlines the complete specifications of the product and is, in our opinion, unique in education. It has been made possible only because of long-range support for continuous development coupled with a rigorous systems development strategy.

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